SUGGESTED PERIODS IN SOUTH ISLAND PREHISTORY

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Abstract. Analysis of artifact classes suggests that South Island prehistory can be subdivided into major periods of change.

This is a preliminary attempt to deduce a pattern of changes from artifact collections, and to relate that pattern to available information regarding South Island prehistory. The artifacts used range from well-documented assemblages down to surface collections. While fairly definite conclusions are possible when analysis is based on well-documented, excavated assemblages, more tentative conclusions are necessary when using results from the analysis of surface collections that may incorporate material from several layers.

ARTIFACTS AND THEIR ANALYSIS

A basic premise in attempting to analyse artifacts by the methods used here is that even with museum and surface collections patterns of change can be deduced. These would be expected in view of the changing ecology of man in southern New Zealand during the prehistoric period. To quote Clarke, "Thus insofar as a culture is an adaptation to a specific environment, a change in the environment may produce changes in the culture to maintain equilibrium inversely proportional to the culture's technological level." (Clarke 1968, p. 128).

Preliminary analyses of artifact groups indicated that the relationship between different groups resembled that expected from a polythetic model which Clarke defined as ". . . a group of entities such that each entity possesses a large number of the attributes of each group, each attribute is shared by large numbers of entities and no single attribute is both sufficient and necessary to the group membership." (Clarke 1968, p. 37). The observed changes between the groups was of such a nature as to suggest a state of "dynamic equilibrium", an equilibrium which is changing continuously along a trajectory yet maintaining stability at any given moment (Clarke 1968, p. 50). In other words, such changes as were observed, appeared to be cumulative rather than revolutionary. This type of change is again what would be expected given our present knowledge of the nature of changes in the environment of the South Island over the last 1000 years.

Earliest occupation in the South Island can be traced back to the initial East Polynesian settlers of the area. Archaeological evidence on economy can be summarized by saying that, from as early as the 10th or 11th century, hunting of the available genera of moa and other species of forest birds was important (see Simmons 1967, p. 35, 1968, p. 121). Food was plentiful and occupation sites were large, with a full range of activities. From the 12th to the 14th century the economy was still based on forest hunting, with a concentration on a reduced range of moa.

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> "Around 1300 A.D. it seems that conditions inimical to the regeneration of rimu, matai and kaikawaka began to develop, became most intense between 1600 and 1800, and had the strongest influence in the east of the South Island . . ." (Wardle 1963, p. 313).

Before this time the island was largely forest covered (Molloy *et al* 1963, p. 74). As moa and forest birds became scarce, more reliance was placed on seashore resources, fish, shellfish and sea mammals (Lockerbie 1959, p. 84). Later, the economy was based principally on fish, shellfish and small birds (Lockerbie 1959, p. 87). This type of economy, with minor variations, continued in Otago until the introduction of potatoes (Hjarno 1967, pp. 43-44, Simmons 1967, pp. 55-56). In Canterbury, kumara were grown as far south as Taumutu, between the Rakaia River and Lake Ellesmere (Shortland 1851, p. 244). The loss of many species of birds was a gradual process and the change from a basic coastal-forest-orientated economy to a basic sea-orientated economy was relatively slow, with a period of adaptation which lasted for at least a century. By contrast, the last major change to a basic potato agriculture economy was swift in Murihiku (Otago-Southland) and accompanied by cultural intrusion, which is clearly recorded at Little Papanui (Simmons 1967). The introduction of kumara agriculture to the northern South Island, probably in the 17th century, was also accompanied by cultural intrusion from the North Island. The North Island origin of the agricultural groups bringing Classic Maori culture is a point that has been made many times (e.g. Skinner 1921, Duff 1956, Hjarno 1967).

This study aims to define the peaks of change in certain material artifacts as one aspect of the cultural system. The original analyses on which this study was based were at first confined to the material from layers at Little Papanui. The method was extended to other sites in the local area, which were connected by the use of identical or apparently similar material and which appeared to be of the same age. When similar results were obtained, the method of analysis was again extended to further sites in Murihiku (Simmons 1967). In this paper a broader study of collections from the entire South Island has been made using the sites listed below and indicated in Fig. 1.

SITES AND SOURCES OF COLLECTIONS USED

Southland

Clifden cache (S167/8) on the Waiau River 96km (60 miles) west of Invercargill. Found together by Mr W. J. Scott on his property at Clifden. Southland Museum.

Pahia (S175/5). 48km (30 miles) west of Invercargill. Collection, associated with moa bone, made by Leslie Mackay from eroding sandhills. Some Classic Maori material from nearby *Pene Bay* could be contained in this collection. Southland and Otago Museums.

Centre Island (—) (Rarotoka), Foveaux Strait. Site of late Maori occupation. Collection by Judge Chapman *c.* 1890. Otago Museum.

Ruapuke Island (—) Foveaux Strait. Centre of late Maori occupation. Southland Museum.

Tokanui Mouth (S183/3) east of Gore. Site of European Maori village (Otara) with earlier occupation on dunes. Southland Museum.

South Otago

King's Rock (S184/6) South Otago. Excavated by Teviotdale and Lockerbie (Lockerbie 1940, 1953, 1954). Otago Museum.

Fig. 1. Map of South Island showing sites.

Papatowai (S184/5) South Otago. Excavated by Teviotdale (1937, 1938a, 1938b) and Lockerbie (1953, 1954, 1959). C14 dates: Layer 1 — A.D. 1185 ± 30, 1195 ± 30; Layer 2 — A.D. 1320 ± 50, 1490 ± 50; Layer 3 — A.D. 1560 ± 80, 1640 ± 60. Otago Museum.

False Island (S184/3) South Otago. Excavated by Lockerbie (1959). C14 dates: A.D. 1480 ± 60, 1605 ± 50, 1630 ± 50, 1660 ± 50, 1735 ± 50. Collection studied mainly surface material. Otago Museum.

Cannibal Bay (S184/4) South Otago. Excavated Lockerbie (1959). C14 dates: A.D. 1500 ± 60. Collection from surface. Otago Museum.

Pounawea (S184/1) South Otago. Excavated by Lockerbie (1954, 1959). C14 dates: Layer 1 — A.D. 1140 ± 60; Layer 2 — A.D. 1400 ± 55; Layer 3 — A.D. 1450 ± 60, 1660 ± 60. Flake material and adzes from two bottom layers. Otago Museum.

Otago

Little Papanui (S164/1) Otago Peninsula. Excavated by Skinner and Teviotdale in 1926-1939 (Simmons 1967). Otago Museum.

Sandfly Bay (—) Otago Peninsula. Excavated by Teviotdale *c.* 1929. Collection by Teviotdale in Otago Museum. Collection by C. Kay held by Mrs Kay, Dunedin. A single layer site.

Tarewai Point (S164/6) Otago Heads. Excavated by Teviotdale (1939a). A European contact period site. Otago Museum.

Anderson's Bay (S164/117) Dunedin Harbour. Excavated by Teviotdale. Collection associated with moa bone. Otago Museum.

Kaikai's Beach (S164/17) Otago Heads. Excavated by Lockerbie (1954, 1959). C14 dates: Bottom layer — A.D. 1050 ± 50 (Hjarno 1967). Upper layer European contact period. Otago Museum.

Murdering Beach (S164/16) Otago Heads. Two sites (Moa-hunter or Ancient Occupation site) on old dunes at back of beach, and recent European contact village destroyed in 1817 on beach flat.
Excavated Skinner in 1929 and Lockerbie (1954, 1959). Collection from Moa-hunter site by P. Pinney. Otago Museum.

Long Beach (S164/20) Otago Heads. Excavated by Dawson and Yaldwyn (1952), Skinner (1953). Lower layer burials with one-piece hooks, middle layer midden containing moa bone, upper layer European contact period. Collection from upper surface layer. Otago Museum.

Karitane (Huriawa) (S155/1) 32km (20 miles) north of Dunedin. Excavation by P. Gathercole and L. M. Groube. A Classic Maori pa site. Collection in Anthropology Department, University of Otago, studied by courtesy P. Gathercole.

Central Otago

Matara (—) near Middlemarch, Central Otago. Collection made by P. George in 1935 from a rock shelter. Otago Museum.

Moa Flat (—) on the Clutha River near Ettrick. Collection from old Moa-flat station made from site on the banks of the Clutha. Associated with moa bone, quadrangular front grip and triangular apex up adzes. Otago Museum.

Glenorchy (S123/7) head of Lake Wakatipu. Collection from Wyuna-Koch site above Glenorchy on an ancient transverse moraine. Excavated in 1967 by Simmons. C14 dates: A.D. 1356 ± 47, 1431 ± 44. Collection made by C. Haines. Otago Museum.

North Otago

Pleasant River (S155/2) North Otago. Excavated by P. Gathercole. Collection, associated with moa bone, in Anthropology Department, University of Otago; studied by courtesy P. Gathercole.

Nenthorn (S145/1) Central Otago, north of Middlemarch. A quartzite quarry. Excavated by M. Trotter (1961). One source of Group 1 and Group 1-2 quartzites (Simmons & Wright 1967). Trotter Collection, Otago Museum.

Shag River (S155/5) North Otago. Excavated Teviotdale (1924) and Hjarno. C14 dates: Layer 1 — A.D. 1127 ± 45, 1105 ± 56. Stratigraphy similar to Pounawea — two layers containing moa bone and an upper layer of shell. Otago Museum.

Mata Kaea (S146/5) Shag Point, North Otago. Excavated by M. Trotter (1965b). No moa bone present. Trotter Collection, Otago Museum.

Waimataitai (S146/2) North Otago. Excavated by M. Trotter (1955, 1965b). C14 dates: (Trotter 1967c) A.D. 1249 ± 47, 1324 ± 30. Trotter Collection, Otago Museum.

Tai Rua (S136/1) North Otago. Excavated by Trotter (1965b) and Gathercole (1961). C14 dates: A.D. 1407 ± 32, 1447 ± 32. Trotter Collection, Otago Museum, and Anthropology Department, University of Otago.

Katiki Point (S146/4) North Otago. A Classic Maori site. Excavated by M. Trotter (1967a). C14 dates: A.D. 1739 ± 56. Trotter Collection, Otago Museum.

Ototara (S136/2) North Otago. Excavated by M. Trotter (1965a). C14 dates: (Trotter, 1967c) A.D. 1422 ± 52, 1483 ± 70. Trotter Collection, Otago Museum.

Waitaki River Mouth (S128/1) North Otago. A very large site covering up to *c.* 50 hectares (125 acres). Excavated by Teviotdale (1939b) and Knight & Gathercole (1961). Collections by Teviotdale, H. S. McCully, M. Trotter in Otago Museum. Main collection held by Stewart Willets, Oamaru, the former owner. The Waitaki cache was found as a unit by Willets.

Oturehua (S134/1) the Becker Quarry above Oturehua, Central Otago. A quarry and working floor for Group 2 quartzite. Excavated in 1967 by F. Leach, Otago University (1969). C14 dates: A.D. 1053 ± 27, 1023 ± 82. Collection studied here was made by Simmons, mainly from one top layer working area in 1966. Otago Museum.

Canterbury

Te Aka Tarewa (S117/6) Waitaki River, Aviemore. Collection, associated with moa bone, made by H. S. McCully. Otago Museum.

Gray's Hills (S109/1) Mackenzie Country. A quartzite quarry. A source of Group 3 and 1-2 quartzites (Simmons & Wright 1967). Collection made by H. S. McCully in 1930. Otago Museum.

Pareora River Mouth (S119/2) South Canterbury. Collections made by C. Griffiths and H. S. McCully. Associated with moa bone. Otago Museum.

Rakaia River Mouth (S93/20) Canterbury. Excavated by Haast in 1870 (1872). Haast Collection, Canterbury Museum.

Bank's Peninsula

Redcliffs (or Sumner) Burials (S84/69) Sumner, Bank's Peninsula. Situated on a former dune line now covered by the main Sumner Road. Excavated by Haast (1875b) and more recently by Duff and Trotter (Trotter 1967b). C14 dates for occupation of a similar type to that recorded by Haast are: A.D. 1163 ± 82.

Redcliffs Cave (Moa Bone Pt Cave) (S84/77) Sumner. Excavated by Haast (1875a), McKay (1875) and Duff (1963). C14 dates for post butts: A.D. 1304 ± 62, A.D. 1310 ± 25. An account of Haast's materials was published by Skinner (1923). Haast Collection, Canterbury Museum.

Monck's Cave (—) Monck's Bay, Sumner. Investigated by Meeson (1890) and written up by Skinner (1924a). Canterbury Museum collection.

Motukarara cache (—) Bank's Peninsula. Recorded by Duff (1940).

North Canterbury

Hurunui cache (—) North Canterbury. Recorded by Duff (1956).

Marlborough

Kapowairua (S10/24-27) Durville I., Marlborough. Site collection in Otago Museum.

Wairau Bar (S29/7) Marlborough. Excavated by Duff (1956) and divided into two main layers — burials and midden layer. C14 dates: midden layer A.D. 1100 ± 50, 1200 ± 50. Eyles and Canterbury Museum collections.

Nelson

Golden Bay (—) Nelson. Surface collections in Otago and Auckland Museums.

Westland

Heaphy River (S7/1) Westland. Excavated by Wilkes and Scarlett (1967). Adzes reported separately by Scarlett (1967). C14 dates: A.D. 1518 ± 70.

Haast River Mouth (—) Westland. Two caches containing mainly large quadrangular front grip and hogback adzes, in Otago Museum.

Anita Bay (—) Milford Sound. Collection made by MacKenzie. Otago Museum.

The presentation of the data from the above sites has been deliberately kept to a crude and non-complex form and no attempt has been made to regularise the distribution patterns. Three classes of artifact were chosen for analysis — adzes, fishhooks and flake tools, because they are ubiquitous and have a continuous distribution in time and space. Items such as ornaments, musical instruments, and several other types of artifact with discontinuous time or space distributions are also included where relevant.

Adzes

Adzes were subject to a multivariable recording system by punch card or code as in Table 1, then analysed to find regularly occurring factors or constellations of factors which delimited a group. Table 1 also includes irregularly occurring factors. The result is 22 forms characterised by a shorthand key based on their most significant features. Invariably, any classification which involves the setting up of type specimens involves an element of choice and attempts to apply it to any artifact collection result in some artifacts being relegated to the "unclassifiable" category or forced into types to which they have only a vague similarity. It was because of such difficulties inherent in the Skinner (1940) and Duff (1956) adze typologies that the present system was adopted for adzes, and later extended to include other artifacts. In this paper, the 16 principal forms employed for classifying adzes are described below (see also Simmons 1967, pp. 13-15).

1. Quadrangular no grip (Figs. 4, 17, 19, 24)
   (a) Cross-section quadrangular or front wider than back.
   (b) Cutting edge straight.
   (c) Length equals two to four times width of cutting edge.

2. Quadrangular no grip greenstone (Fig. 25)
   The same as above but made in greenstone.

3. Greenstone chisel and gouge
   (a) Cross-section quadrangular or circular.
   (b) Cutting edge straight or gouge.
   (c) Length equals four times width of cutting edge.

4. Flake adze
   (a) Cross-section irregular.
   (b) Made from a waste flake.
   (c) No grip.
   (d) Length less than 4cm.
   (e) Length equals two or three times width of cutting edge.

5. Slight spade shoulder (Figs. 15, 28)
   (a) Cross-section lenticular, quadrangular rounded front and back, or rectangular front wider than back.
   (b) Grip produced by hammer dressing or flaking sides but reduction is less than 2mm and no definite shoulder is produced.
   (c) Cutting edge straight or shallow gouge edge.
   (d) Length equals five to seven times width of cutting edge.

Table 1. Record of some factors on twenty-eight adzes, chosen to show the range of factors present.

Form	Cross-section	Shape	Factors
1	Quadrangular	Thick, F = B	H C S
2	Quadrangular	Thin, F = B	H A R
3	Rectangular	Thick, F > B	K B R
4	Rectangular	Thin, F > B	H B Q U
			H D R
			H G S
5	Reversed Rectangular	Thick, F < B	H A P
6	Reversed Rectangular	Thin, F < B	K A S
7	Triangular	Thick, Apex F	H A R
8	Triangular	Thin, Apex F	H A R
9	Truncated Triangular	Thick, Apex F	H B L W X
10	Truncated Triangular	Thin, Apex F	H A R
11	Triangular	Thick, Apex B	K A Q
12	Triangular	Thin, Apex B	H D R
			H D S
13	Truncated Triangular	Thick, Apex B	H B R
14	Truncated Triangular	Thin, Apex B	K D M
15	Semicircular	Base B	K B N W
16	Semicircular	Base F	H A S
17	Diamond		K A Q
18	Triangular	Apex R	K E S
19	Triangular	Apex L	K E S
20	Lenticular		K G N
21	Rounded		H G P
22	Circular		H A M
			K B P

Key

Thick: Width > 2 times thickness
Thin: Width < 2 times thickness
F > B: Front wider than back
F < B: Front narrower than back
Apex F: Apex to front
Apex B: Apex to back
Base B: Base to back
Base F: Base to front
Apex R: Apex to right
Apex L: Apex to left

A No grip
B Front grip reduced > 2mm
C Angled butt > 2mm
D Sides reduced > 2mm marked spade
E One side reduced
F Reduced > 2mm
G Slight spade sides reduced < 2mm
H Cutting edge straight
I „ „ skew right
J „ „ skew left
K „ „ gouge

L Length ÷ cutting edge = 9
M „ „ „ „ = 8
N „ „ „ „ = 7
O „ „ „ „ = 6
P „ „ „ „ = 5
Q „ „ „ „ = 4
R „ „ „ „ = 3
S „ „ „ „ = 2
T Chin on bevel
U Horns on poll
V Horns on shoulder
W Single horn poll
X Single horn shoulder
Y Ridge on grip
Z Ridge on shoulder

6. Marked spade shoulder (Figs. 5, 14, 22)
   (a) Cross-section rectangular front wider than back or triangular apex to back.
   (b) Grip produced by reduction of sides more than 2mm so as to produce a definite shoulder.
   (c) Cutting edge straight or hollow (gouge).
   (d) Length equals two or three times cutting edge.

7. Greenstone spade shoulder (Figs. 23, 26, 27)
   This includes both marked and slight spade forms in greenstone. Other variables are the same except for a flattening or reduction of thickness in cross-sections.

8. Quadrangular front grip (Figs. 3, 11, 13, 20)
   (a) Cross-section quadrangular or quadrangular front wider than back.
   (b) Grip produced by reduction of the front surface of the butt more than 2mm from the plane of the surface.
   Note. Angled butt forms are also included here though strictly in terms of other variables such as concavity/convexity of front and back, these should be a separate form.
   (c) Cutting edge straight or occasionally gouge (hollow ground).
   (d) Length equals two, or more usually three, times width of cutting edge.
   (e) Other features occurring more rarely are horns on the poll shoulder or chin.

9. Reversed quadrangular no grip (Fig. 6)
   (a) Cross-section quadrangular back wider than front, thick and thin forms.
   (b) Cutting edge straight or occasionally hollow ground (gouge).
   (c) Length equals 5 or 2 times width of cutting edge.
   (d) Front of butt may be angled by flaking, polishing.

10. Reversed quadrangular grip
   (a) Cross-section as above, rarely the thin form.
   (b) Grip produced by reduction of front usually by hammer dressing and rounding of butt section.

11. Triangular apex up grip (hogback) (Figs. 2, 12)
   (a) Cross-section triangular, thick section, apex to front.
   (b) Grip by reduction of front to truncate apex of triangle.
   (c) Length equals nine times width of cutting edge.
   (d) Occasionally single horn on poll or on chin.

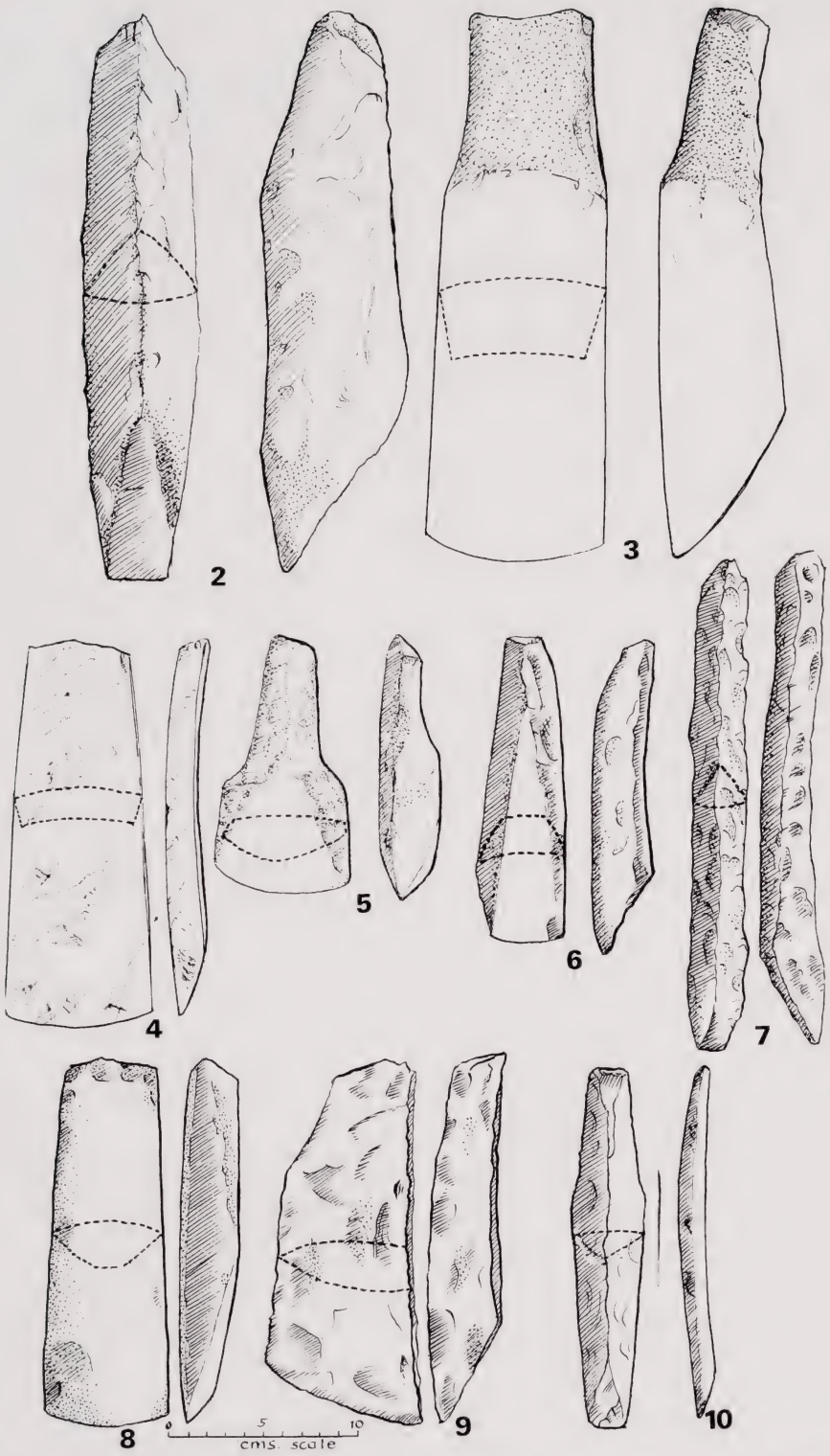
12. Triangular apex up no grip (Fig. 7)
   (a) Cross-section triangular and truncated.
   (b) Cutting edge straight.
   (c) Length equals three times width of cutting edge.

13. Triangular apex down grip (coffin shape) (Fig. 10, 18)
   (a) Cross-section thin triangular.
   (b) Grip by reduction of sides more than 2mm.
   (c) Length equals eight times width of cutting edge.
   (d) Cutting edge hollow ground (gouge).
   (e) In the coffin shape form the width of the shoulders is one and a half times that of the cutting edge, which is narrow for the total length of the adze.

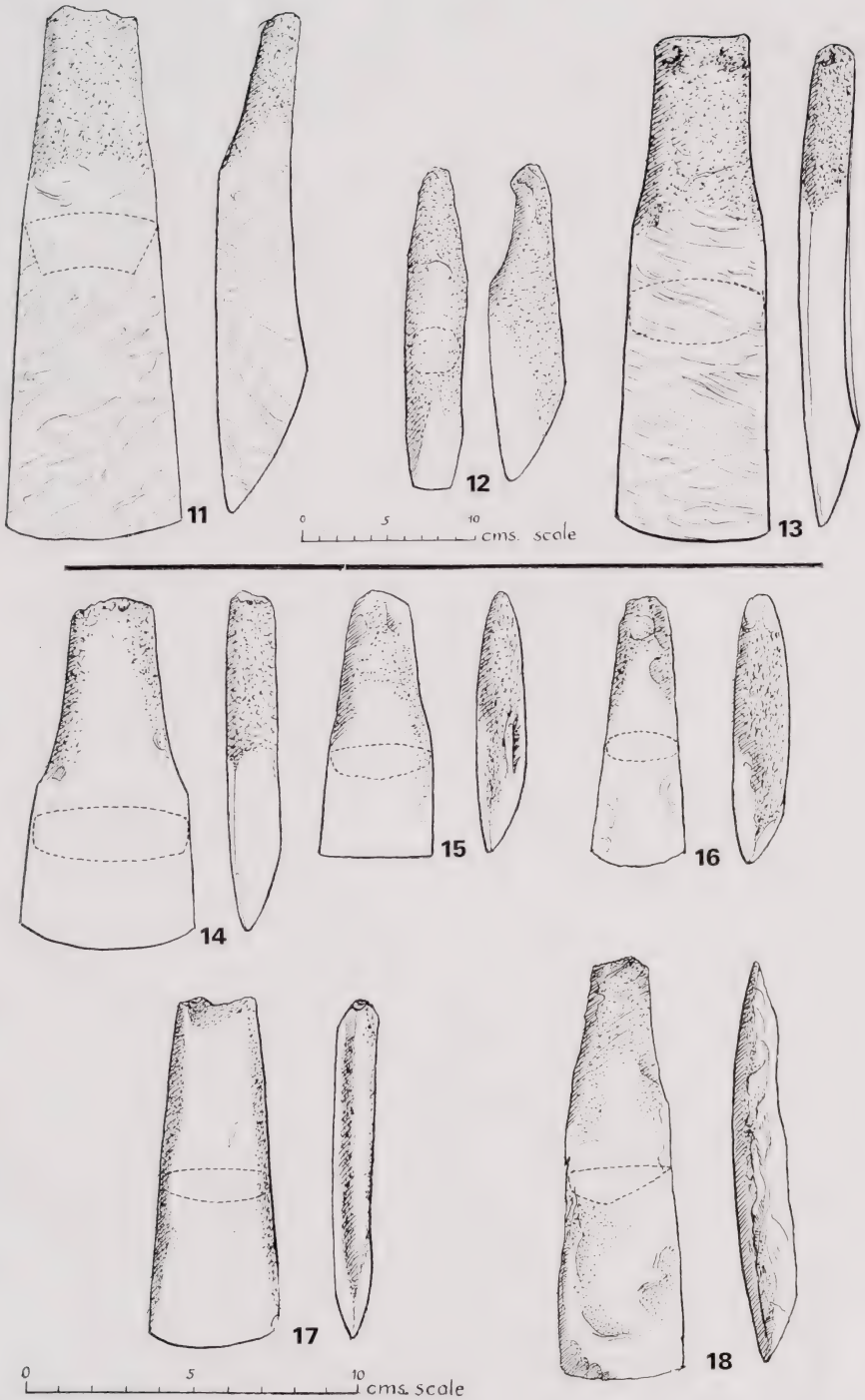
14. Triangular apex down no grip (Fig. 8)
   (a) Cross-section thin triangular.
   (b) Cutting edge gouge usually extending up adze and ending in a point.
   (c) Length equals four times width of cutting edge.

15. Side hafted (Fig. 9)
   (a) Cross-section triangular apex to right or to left.
   (b) Grip produced by reduction of one side to produce a definite shoulder.
   (c) Cutting edge hollow ground (gouge) usually point of bevel is off centre.
   (d) Length equals two times width of cutting edge.

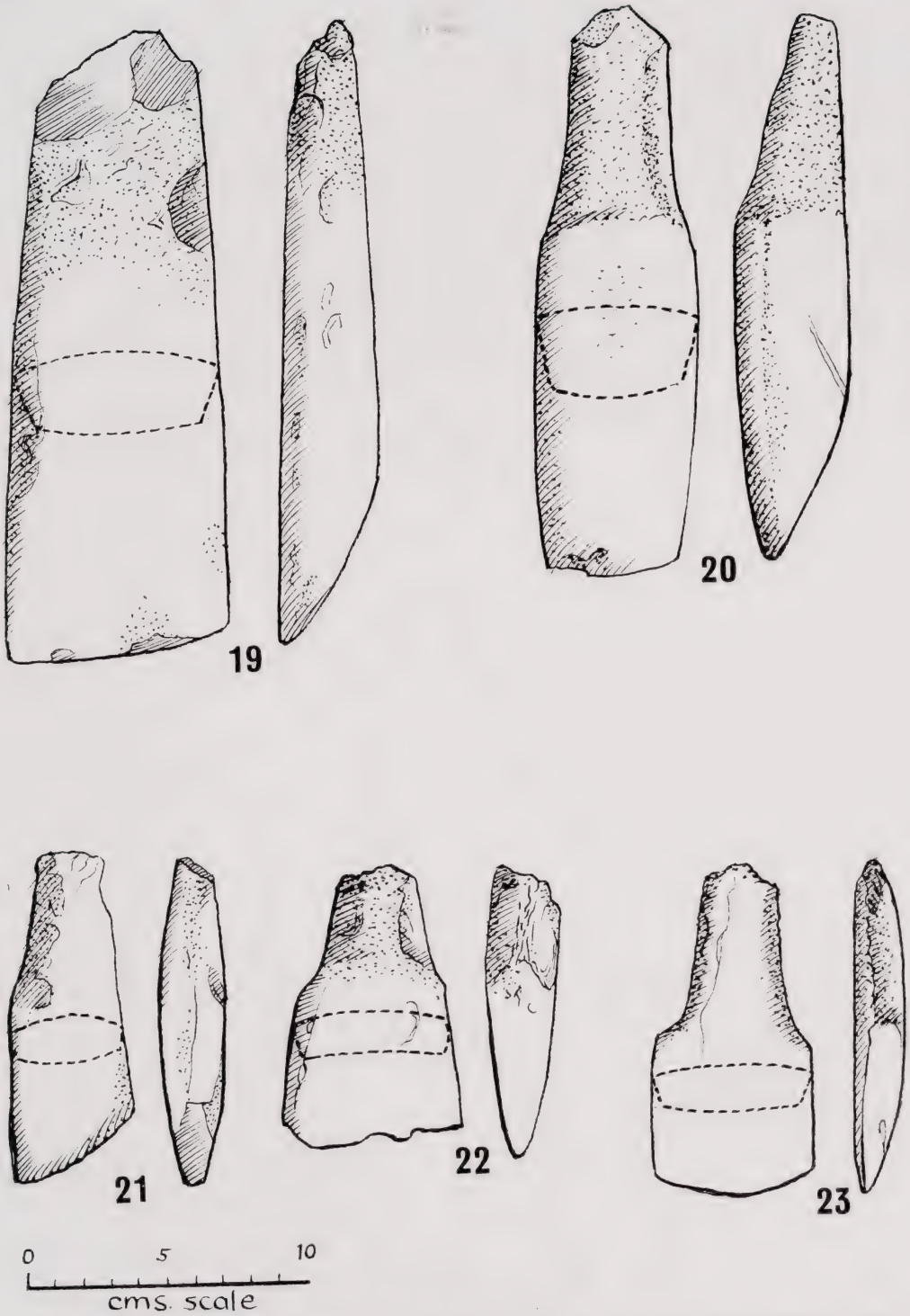
16. Ovoid or semi-circular (Fig. 16)
   (a) Cross-section ovoid, semi-circular, rounded, circular.
   (b) No grip.
   (c) Length equals five to seven times width of cutting edge.
   (d) Total length not more than 7cm.
   (e) Cutting edge straight or gouge.



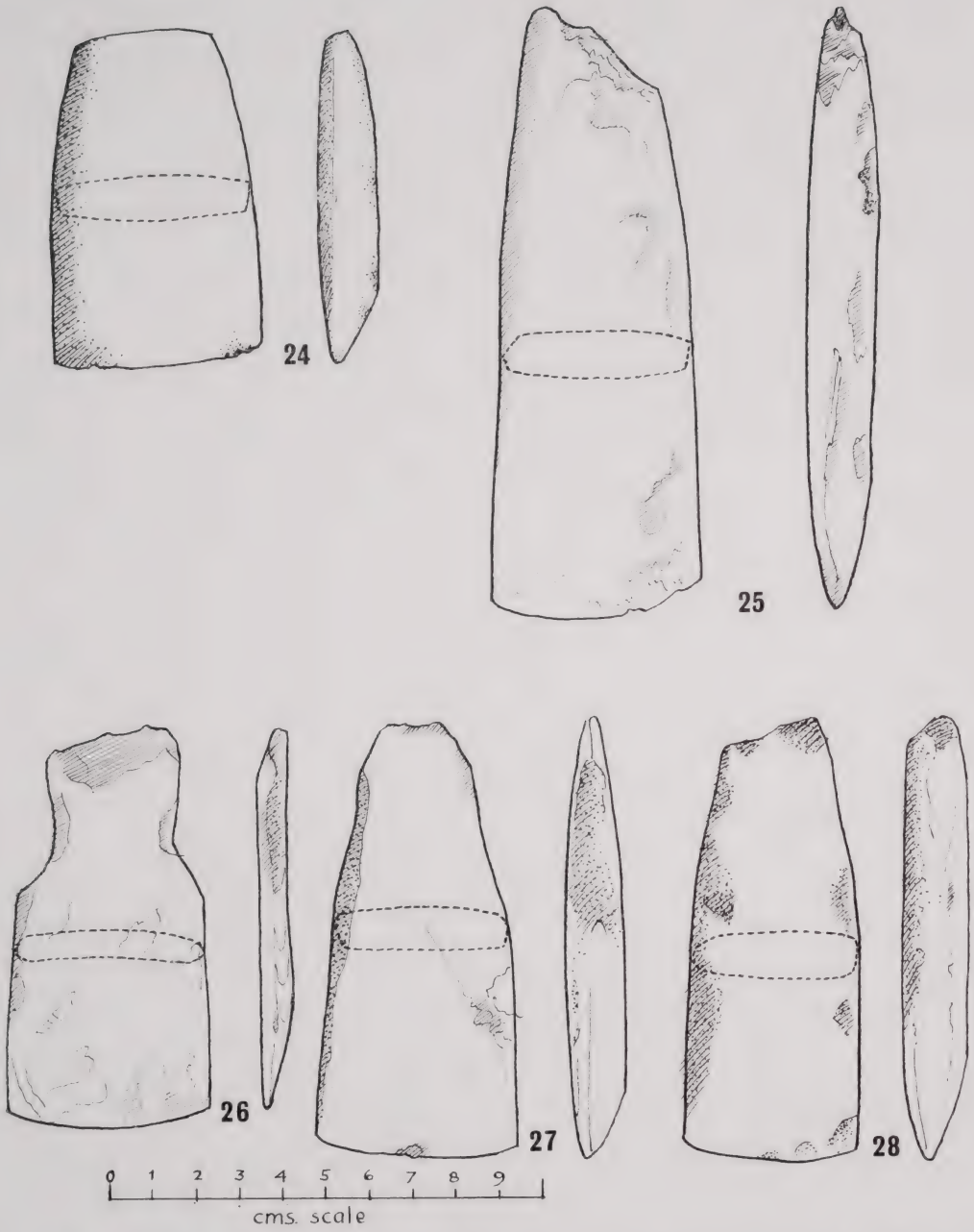
Figs. 2-10. Typical Early Period adzes. 2. Dominant triangular apex up grip, A.M.5846 Long Beach. 3. Dominant quadrangular front grip, A.M.2548.2 Paparoa Inlet. 4. Quadrangular no grip, A.M.23230 Pelorus Sound. 5. Marked spade shoulder, A.M.22433.3 Durville I. 6. Reversed quadrangular, Houhora. 7. Triangular apex up no grip (after Skinner 1938). 8. Triangular apex down no grip, A.M.29607 Normanby. 9. Side hafted, A.M.8277. 10. Triangular apex down with grip (after Skinner 1938) (plan view reversed).



Figs. 11-18. Typical Middle Period adzes. 11. Dominant quadrangular front grip argillite, A.M.25530 Moa Bone Pt Cave (from Haast's excavation on sandhills, Sumner. 12. Dominant small hogback of rounded cross-section, A.M. 30128.2 Southland. 13. Quadrangular front grip in nephrite, A.M.30210. 14. Marked spade shoulder, A.M.7918 Long Beach. 15. Slight spade shoulder, A.M.27217 Tuamarina. 16. Ovoid A.M.28217.3 Otago. 17. Quadrangular no grip, A.M.24997 Akaroa. 18. Triangular apex down with grip, A.M. 30139 Southland.



Figs. 19-23. Typical Intermediate Period adzes. 19. Dominant quadrangular no grip, A.M.14586 Ruapuke I. 20. Dominant rounded quadrangular front grip, A.M.16157 Southland. 21. Skew adze with grip on one side, A.M.7944. 22. Spade shoulder in ordinary stone, A.M.1324.7 Southland. 23. Spade shoulder in nephrite, A.M.30138.4 Southland.



Figs. 24-28. Typical Late Period adzes. 24. Dominant quadrangular no grip in ordinary stone, A.M.29353.4 Otira. 25. Dominant quadrangular no grip in nephrite, A.M.5783 Murdering Beach. 26. Marked spade shoulder in nephrite, A.M.5808 Murdering Beach. 27. Slight spade shoulder in nephrite, A.M.5825 Murdering Beach. 28. Slight spade in ordinary stone, A.M.7930 Murdering Beach.

RESULTS OF ANALYSIS

Tables 2 and 3 show the percentage and numerical distributions of these forms in the sites. Groupings became evident during analysis. These were:—

1. Collections with a dominance of Triangular apex up grip adzes. (Fig. 29, e.g. Heaphy, Wairau Bar Midden, Pounawea).
2. Collections with equal dominance of Triangular apex up grip and Quadrangular front grip adzes. (Fig. 29, e.g. Sumner, and the caches at Hurunui and Clifden).
3. Collections with a dominance of Quadrangular front grip adzes in which numbers of Triangular apex up grip adzes are still present. (Fig. 30, e.g. Rakaia, Waitaki, Wairau Bar Burials).
4. Collections with a dominance of Quadrangular front grip adzes. (Figs. 30, 31, e.g. the caches at Motukarara and Haast, Papatowai, Little Papanui bottom, Tokanui Mouth).
5. Collections in which Quadrangular no grip adzes dominate, yet still possess some quadrangular gripped adze forms. (Fig. 32, e.g. Little Papanui middle, Shag R. top, King's Rock).
6. Collections with a dominance of Quadrangular no grip adzes made in greenstone. Fig 33, e.g. Tarewai Pt, Murdering Beach).

During the analysis it became evident that 2 was transitional between 1 and 3, and that 5 was transitional between 4 and 6, leaving four major groups. Reference to C 14 dates for some of the collections in these groupings in conjunction with the typological sequence is also a temporal one.

The various caches were included in the analysis to see if they also reflected the general tendency to change even though the small number involved in each distort the statistics to a certain extent. That the caches do reflect the tendencies of the other collections of their group is shown in Figures 29 and 30.

As far as the percentage distribution of adzes is concerned, the graphs would appear to reflect a state of "dynamic equilibrium", in a continuously changing system.

If the sites are ordered in the same way as in Table 2, then the length range of adzes recorded in Fig. 34 results. For convenience, the median length rather than the mean has been taken to illustrate the dispersion of artifacts within the range. In the total collection, the overall length of adzes in the lower part of the graph (e.g. Heaphy) does not overlap the very long adzes of Waitaki River or Wairau Bar Burials, while in the upper part of the graph length decreases (Fig. 34). The adzes are generally more massive in the mid part of the graph, length is one indication of this.

If the dominant adze classes are taken separately, the same trends are apparent:

(a) Quadrangular front grip adzes tend to include larger examples at Wairau Bar Burials in the middle of the graph. In the upper part of the graph they drop out (Fig. 35).

(b) Triangular apex up grip adzes show a pattern along the same lines (Fig. 36) with long adzes at Waitaki River and Wairau Bar Burials, then becoming rare before becoming absent.

(c) Quadrangular no grip adzes show an unchanging tendency, but are of sporadic occurrence in the lower portion of the graph (Fig. 37). Duff (1956) distinguished between the two ends of this graph by labelling the lower ones Type 2A and the upper group 2B. No real criteria could be established for this division.

Table 2. Percentage distribution of adze forms in South Island sites.

	Quadrangular no grip	Quadrangular greenstone	Chisel/gouge greenstone	Flake adze	Slight spade shoulder	Marked spade shoulder	Spade shoulder greenstone	Quadrangular front grip	Reversed quadrangular no grip	Reversed quadrangular grip	Triangular apex up grip	Triangular apex up no grip	Triangular apex down grip	Triangular apex down no grip	Side hafted	Ovoid	Total adzes	% Greenstone	% Argillite
Moa Bone Pt Cave	.	54	30	.	.	.	.	.	.	.	.	.	.	.	.	15	13	77	13
Katiki Pt (Trotter)	.	50	50	.	.	.	.	.	.	.	.	.	.	.	.	.	12	100	.
Murdering Beach Classic	15	54	25	4	2	2	5	.	.	.	.	.	.	.	.	2	272	85	1
Tarewai Pt	31	40	15	2	7	3	3	.	.	.	.	.	.	.	.	.	56	56	7
Little Papanui, top layers	52	12	15	12	7	2	2	.	.	.	.	.	.	.	.	.	108	31	1
Monck's Cave	65	.	.	7	.	7	.	14	.	.	7	.	.	.	.	.	14	.	29
Sandfly Bay	29	.	17	17	8	4	8	17	.	.	.	.	.	.	.	.	24	25	0
King's Rock	31	.	.	.	23	16	.	23	.	7	.	.	.	.	.	.	13	23	7
Shag River, top layer	33	16	10	6	10	3	6	13	3	3	.	1	.	.	.	6	31	33	1
Golden Bay	31	.	.	15	11	8	.	14	.	.	4	.	1	7	1	5	98	.	80
Orepuke	36	2	3	15	8	6	.	25	.	.	2	2	.	.	.	2	85	6	50
Little Papanui, middle layers	33	.	10	7	19	10	.	28	.	5	.	.	.	10	.	.	21	.	5
Shag River, bottom layer	14	5	.	16	11	20	.	14	2	.	5	.	.	5	.	8	37	5	3
Pareora River	14	4	12	10	8	2	12	16	4	.	.	4	.	.	.	4	50	28	63
Pahia	19	1	17	7	6	8	1	20	.	1	12	2	1	1	.	3	128	20	4
Tokanui Mouth	15	.	7	22	5	12	2	22	.	1	7	.	.	.	.	7	55	7	.
Little Papanui, bottom layers	7	4	2	16	10	15	1	24	.	3	5	.	.	2	.	1	92	9	2
Papatowai	9	2	.	4	9	4	.	25	2	3	7	7	3	7	.	.	52	4	4
Haast River (cache)	7	.	.	.	.	.	.	14	7	.	7	13	.	7	.	13	15	.	90
Waitaki 1 (cache)	20	.	.	.	.	.	.	40	.	.	20	.	.	20	.	.	5	.	40
Motukarara (cache) (Duff 1940)	3	3	.	.	.	.	.	52	.	.	30	.	6	3	3	3	31	3	97
Wairau Bar Burials (Duff 1956)	38	.	.	3	.	3	.	30	.	.	19	.	3	1	3	3	64	3	88
Waitaki River	12	1	6	8	3	4	1	31	1	1	25	1	3	1	1	1	346	11	45
Rakaia River	7	8	10	10	6	.	3	20	.	.	13	6	6	.	.	3	30	20	43
Clifden (cache)	.	.	.	.	.	.	.	29	.	.	29	14	.	14	.	14	7	0	57
Hurunui (cache) (Duff 1956)	.	.	.	.	.	.	.	32	.	.	32	.	.	12	6	17	17	.	80
Sumner (including Moa Bone Pt Cave dirt beds)	25	.	.	8	3	.	.	18	8	3	18	3	3	3	3	5	38	.	80
Pounawea	3	3.	.	19	3	19	3	22	.	.	25	.	.	.	3	.	28	4	4
Wairau Bar Midden (Duff 1956)	29	.	.	.	.	5	.	15	3	.	24	.	13	7	2	2	132	.	92
Heaphy	30	4	11	.	.	2	.	6	2	.	28	8	.	4	.	6	43	16	84
Wairau Bar total (to show effect of undifferentiated site collections)	18	.	3	27	1	2	1	13	.	2	23	1	2	3	2	3	351	3	90

Table 3. Numerical distribution of adze forms in South Island sites.

	Quadrangular no grip	Quadrangular greenstone	Chisel/gouge greenstone	Flake adze	Slight spade shoulder	Marked spade shoulder	Spade shoulder greenstone	Quadrangular front grip	Reversed quadrangular no grip	Reversed quadrangular grip	Triangular apex up grip	Triangular apex up no grip	Triangular apex down grip	Triangular apex down no grip	Side hafted	Ovoid	Total adzes
Moa Bone Pt Cave	.	.	7	4	.	.	.	.	.	.	.	.	.	.	.	2	13
Katiki Pt (Trotter)	.	.	6	6	.	.	.	.	.	.	.	.	.	.	.	.	12
Murdering Beach Classic	41	110	79	11	5	5	12	.	.	.	.	.	.	.	.	4	272
Tarewai Pt	20	26	10	1	4	3	1	.	.	.	.	.	.	.	.	.	56
Little Papanui, top layers	53	13	16	13	8	3	2	.	.	.	.	.	.	.	.	.	108
Monck's Cave	9	.	.	1	.	1	.	2	.	1	.	.	.	.	.	.	14
Sandfly Bay	7	.	4	4	2	1	2	4	.	.	.	.	.	.	.	.	24
King's Rock	4	.	.	.	3	2	.	3	1	.	.	.	.	1	.	.	13
Shag River, top layer	10	5	3	2	3	1	4	1	.	.	.	.	.	.	.	2	31
Golden Bay	31	.	.	16	8	11	.	14	.	.	4	1	7	1	5	.	98
Orepuke	31	2	2	12	6	4	.	21	.	.	2	2	.	.	.	2	85
Little Papanui, middle layers	7	.	1	2	3	.	6	.	1	.	1	1	.	.	.	.	21
Shag River, bottom layer	5	2	.	6	4	7	.	5	1	.	2	.	.	2	.	3	37
Pareora River	7	2	6	5	4	1	6	8	2	.	5	2	.	.	.	2	50
Pahia	25	2	23	9	7	10	2	26	1	15	3	2	1	4	.	.	128
Tokanui Mouth	8	.	4	12	3	6	1	12	.	1	.	.	.	.	.	4	55
Little Papanui, bottom layers	5	4	11	15	9	13	1	22	.	3	4	1	.	2	.	1	92
Papatowai	5	1	.	8	5	8	.	13	4	4	4	2	.	.	.	.	52
Haast River (cache)	2	.	.	.	.	.	.	6	1	.	1	2	.	1	.	1	15
Waitaki 1 (cache)	1	.	.	.	.	.	.	2	.	.	1	.	.	1	.	.	5
Motukarara (cache) (Duff 1940)	1	1	.	.	.	.	.	16	.	.	9	.	2	.	.	1	31
Wairau Bar Burials (Duff 1956)	18	.	.	.	.	1	.	19	.	.	12	.	5	6	1	2	64
Waitaki River	28	3	17	29	13	15	5	115	4	3	86	4	10	6	5	6	346
Rakaia River	5	2	3	3	2	.	1	6	.	.	4	2	2	.	.	1	30
Clifden (cache)	.	.	.	.	.	.	.	2	.	.	2	1	.	1	.	1	7
Hurunui (cache) (Duff 1956)	.	.	.	.	.	.	.	5	.	.	5	.	3	.	4	.	17
Sumner (including Moa Bone Pt Cave dirt beds)	10	1	.	3	1	1	.	7	3	1	1	7	1	1	1	2	38
Pounawea	1	1	.	5	1	5	1	6	.	.	7	.	.	.	1	.	28
Wairau Bar Midden (Duff 1956)	38	.	.	.	.	7	.	23	4	0	32	.	17	6	2	3	132
Heaphy	15	3	3	.	.	1	.	3	.	14	4	.	.	.	.	.	43
Wairau Bar total	65	6	6	94	5	7	2	46	9	.	80	4	8	10	1	8	351

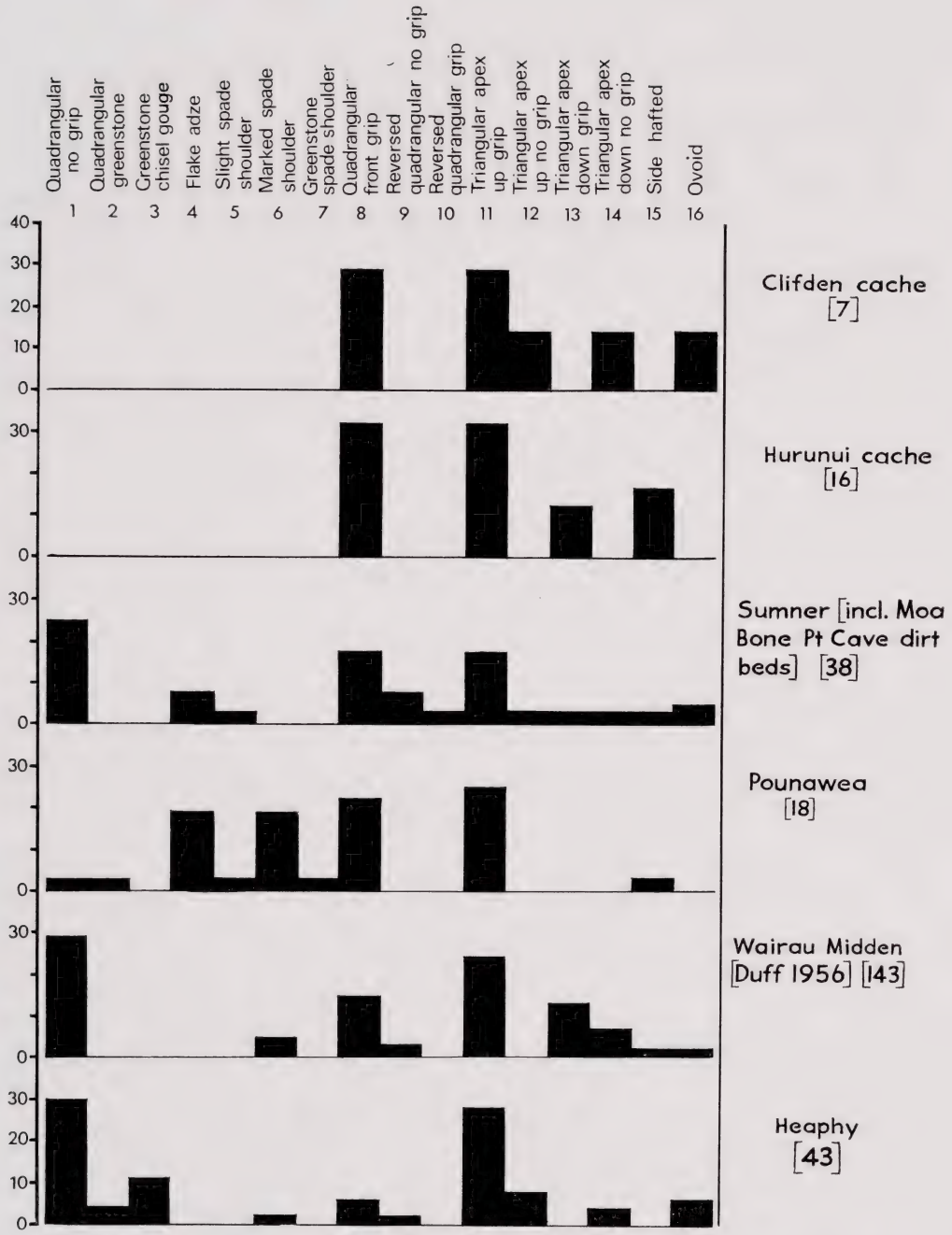


Fig. 29. Percentage distribution of adze forms. Part 1. Dominants triangular apex up to quadrangular front grip.

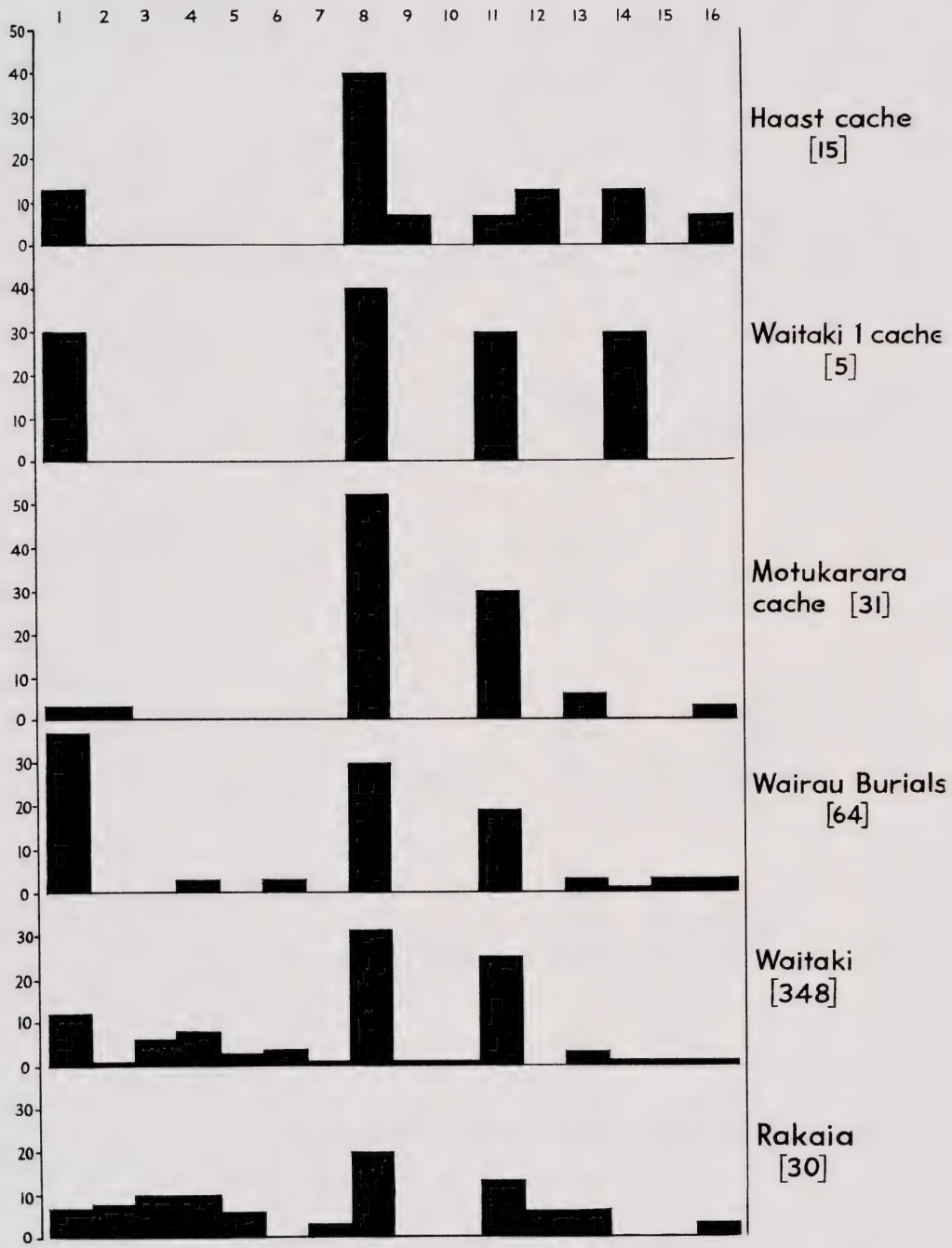


Fig. 30. Percentage distribution of adze forms. Part 2. Dominant quadrangular front grip.

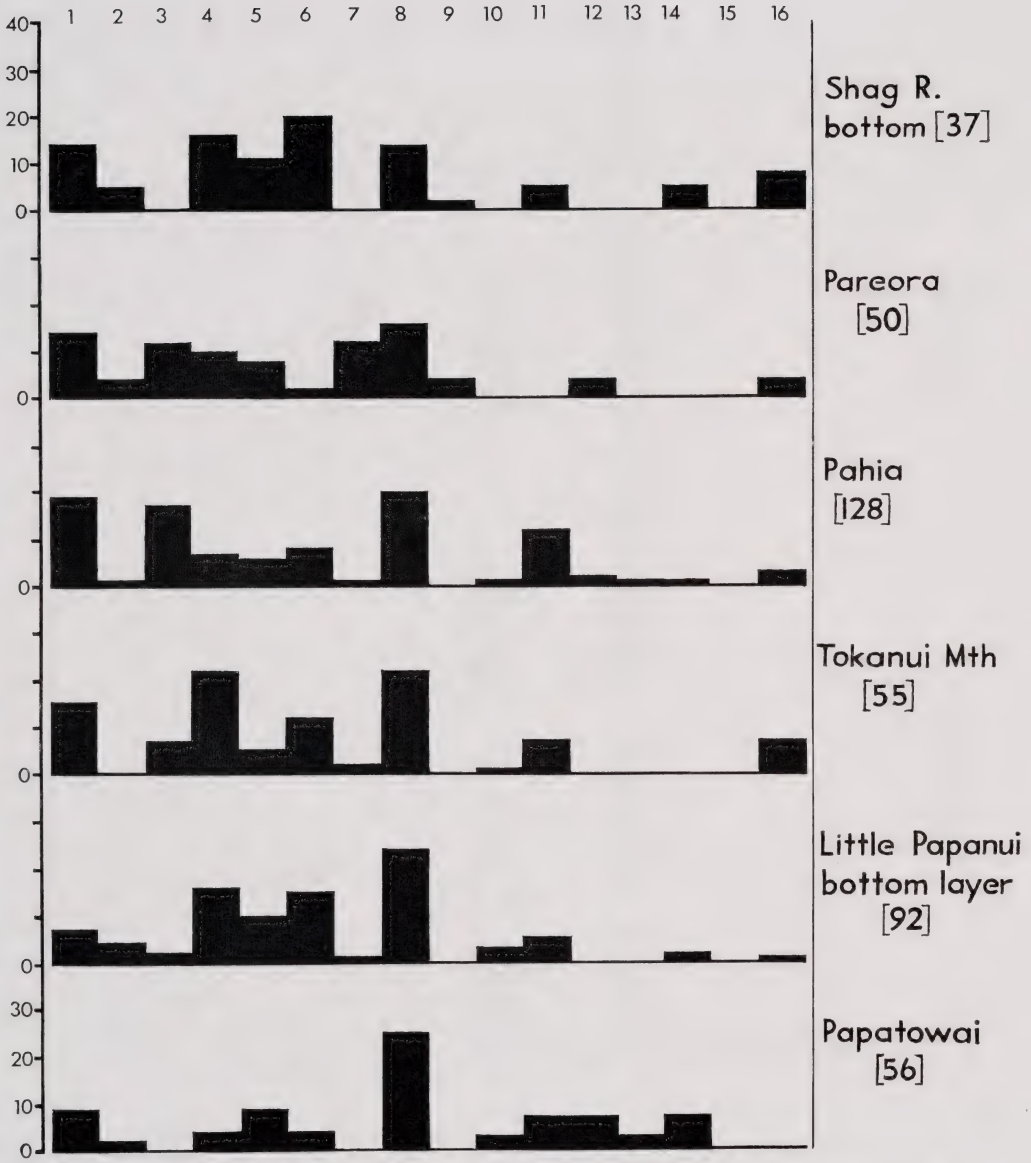


Fig. 31. Percentage distribution of adze forms. Part 3. Dominant quadrangular front grip to marked spade.

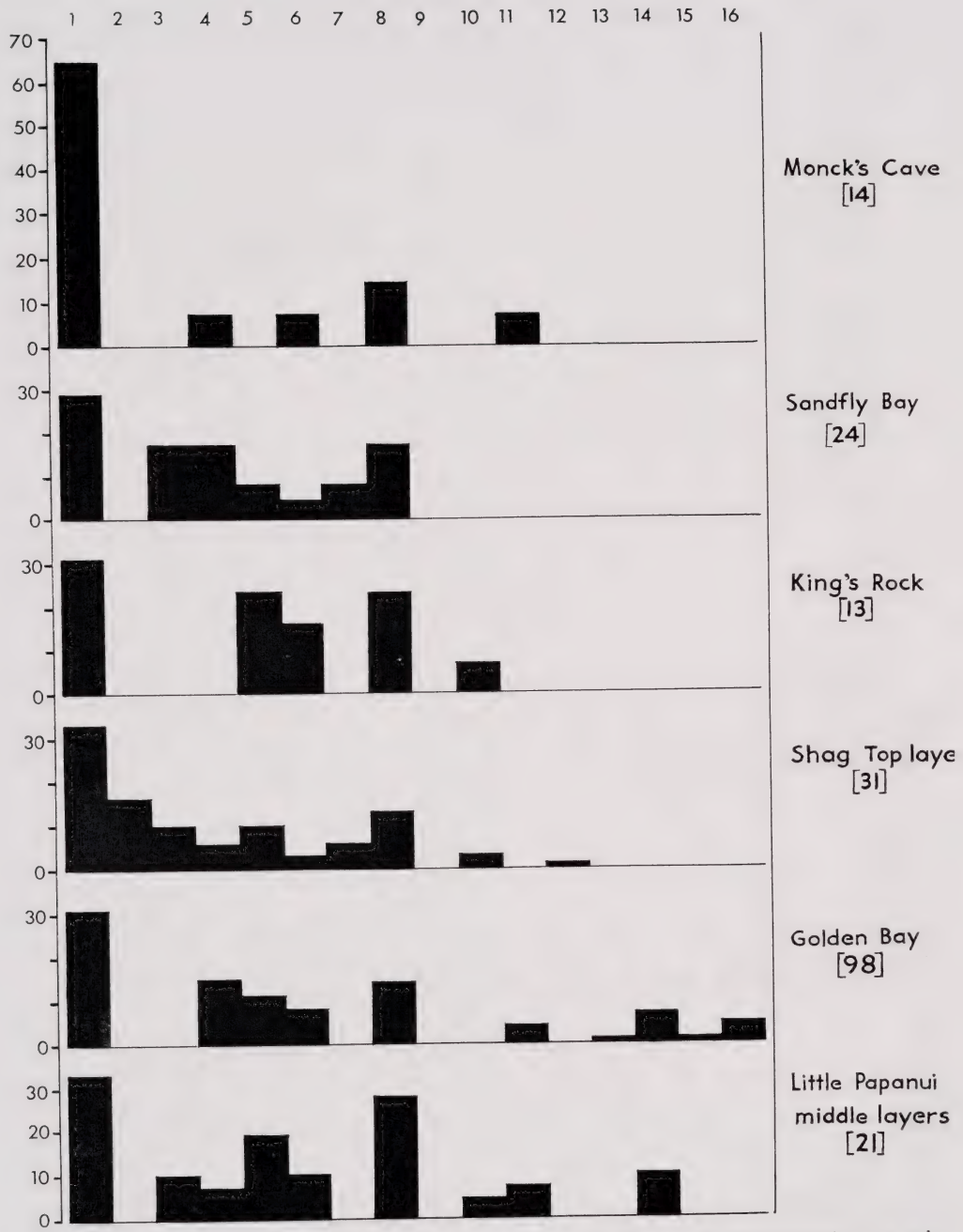


Fig. 32. Percentage distribution of adze forms. Part 4. Dominant quadrangular no grip in ordinary stone.

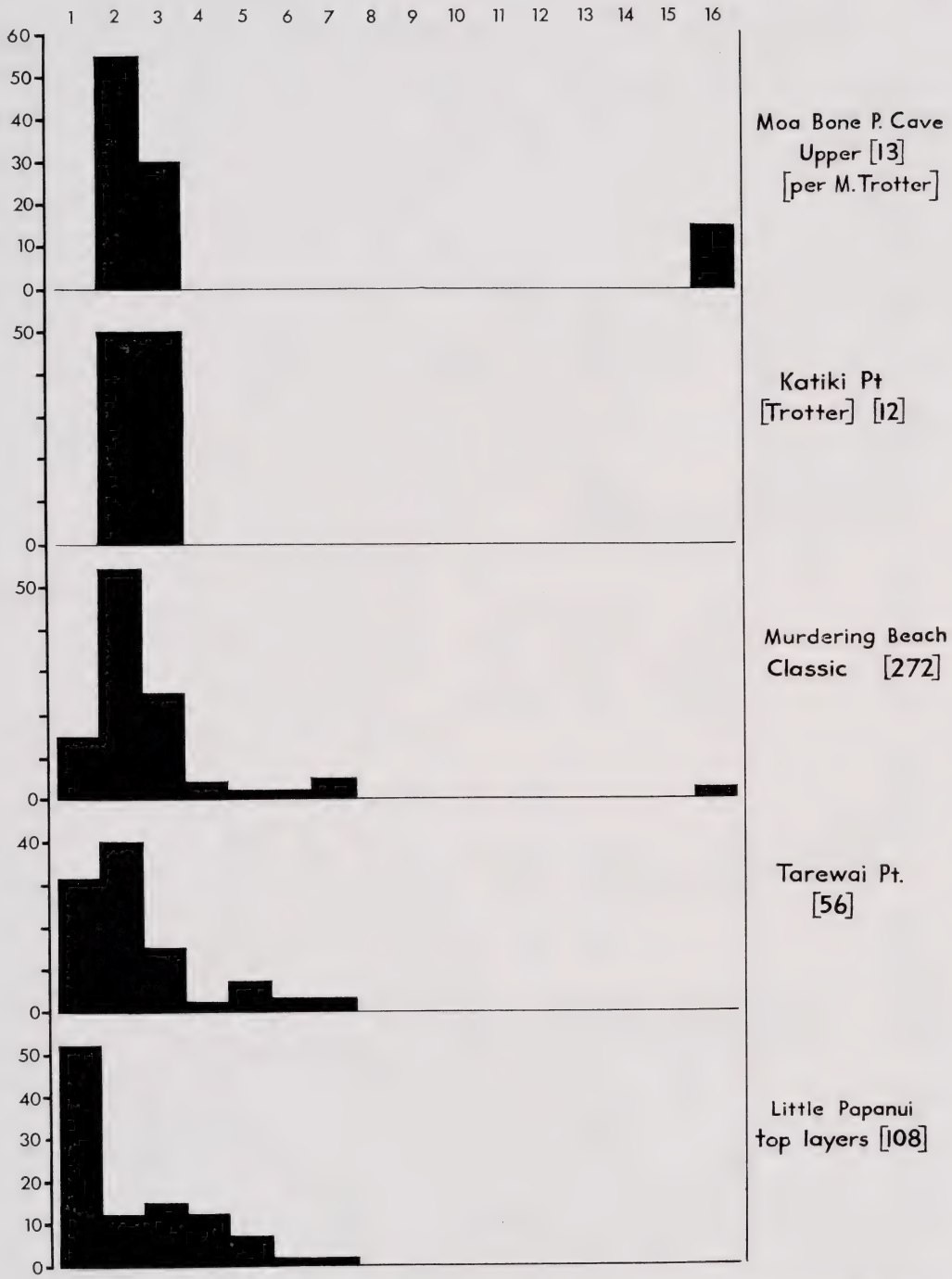


Fig. 33. Percentage distribution of adze forms. Part 5. Dominant quadrangular no grip in nephrite.

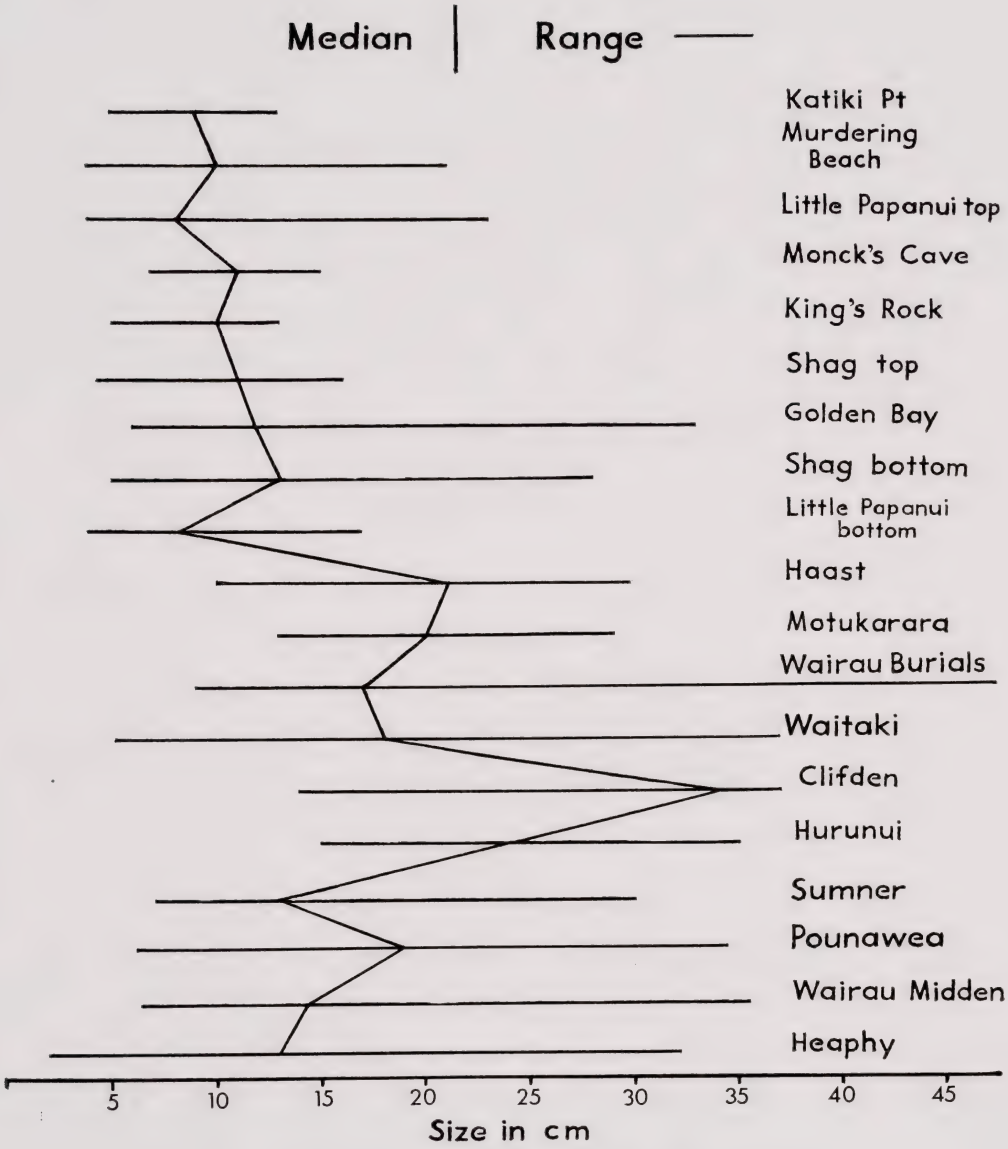


Fig. 34. Median and length range of total adze assemblages.

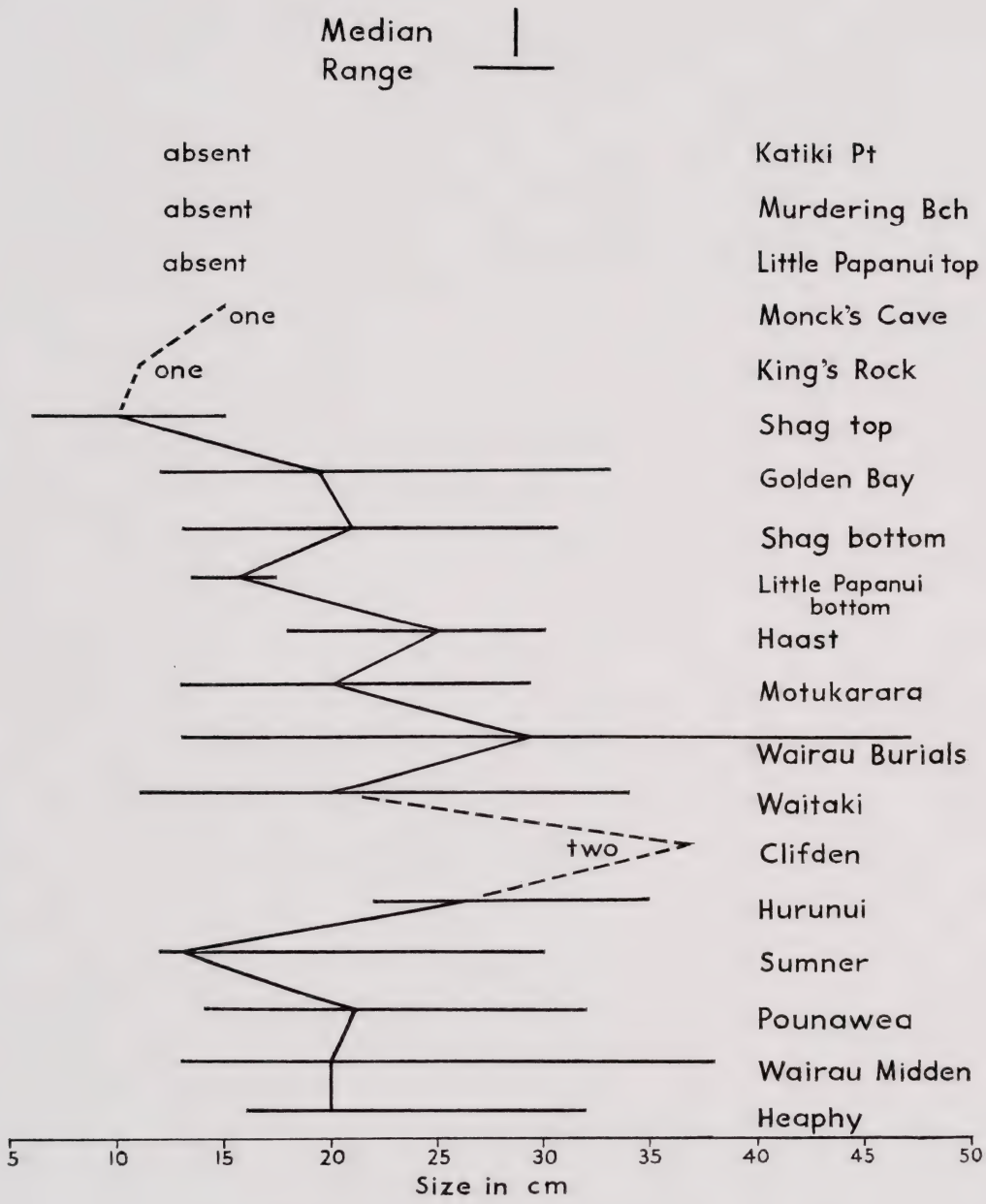


Fig. 35. Median and length range of quadrangular front grip adzes.

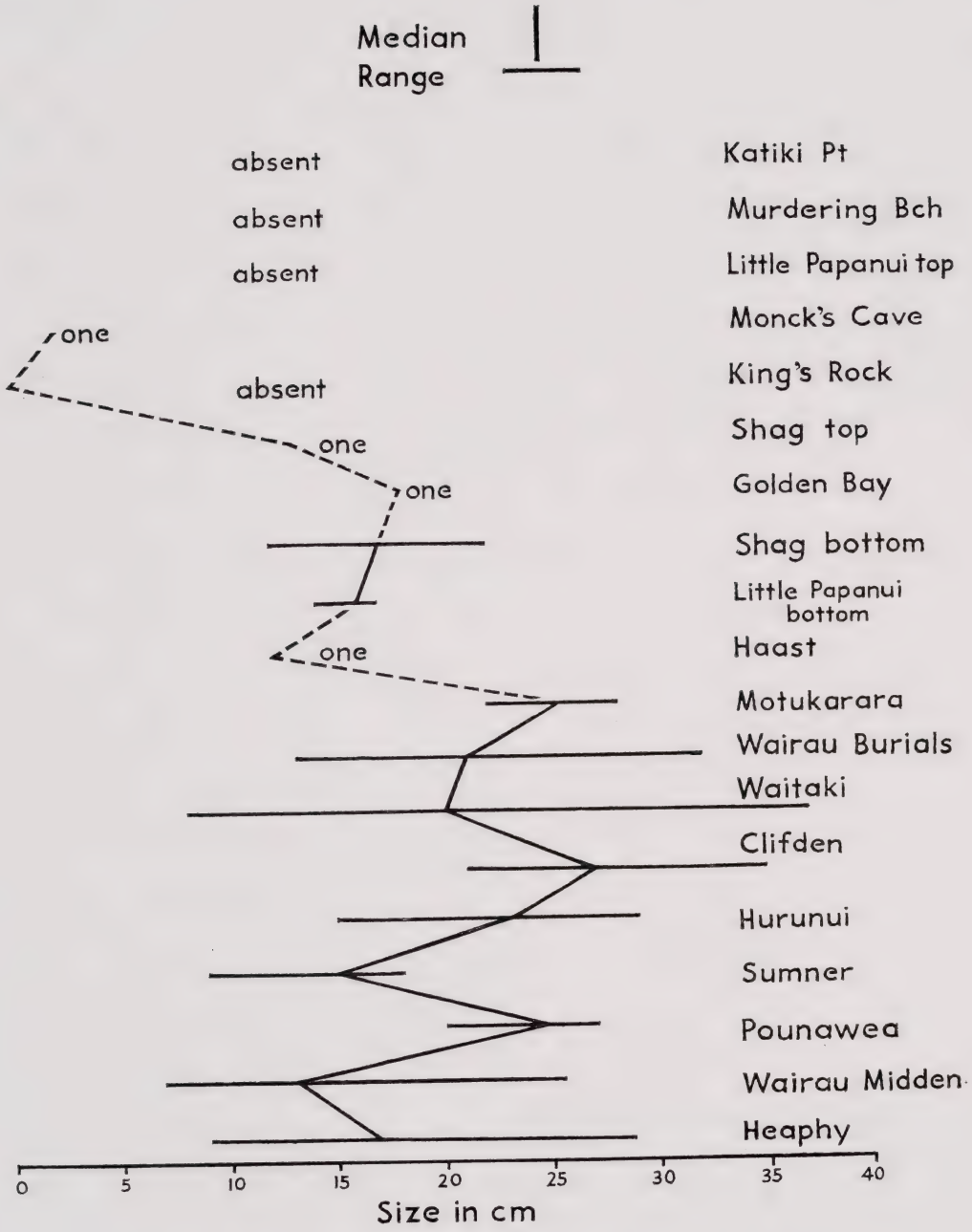


Fig. 36. Median and length range of triangular apex up grip adzes.

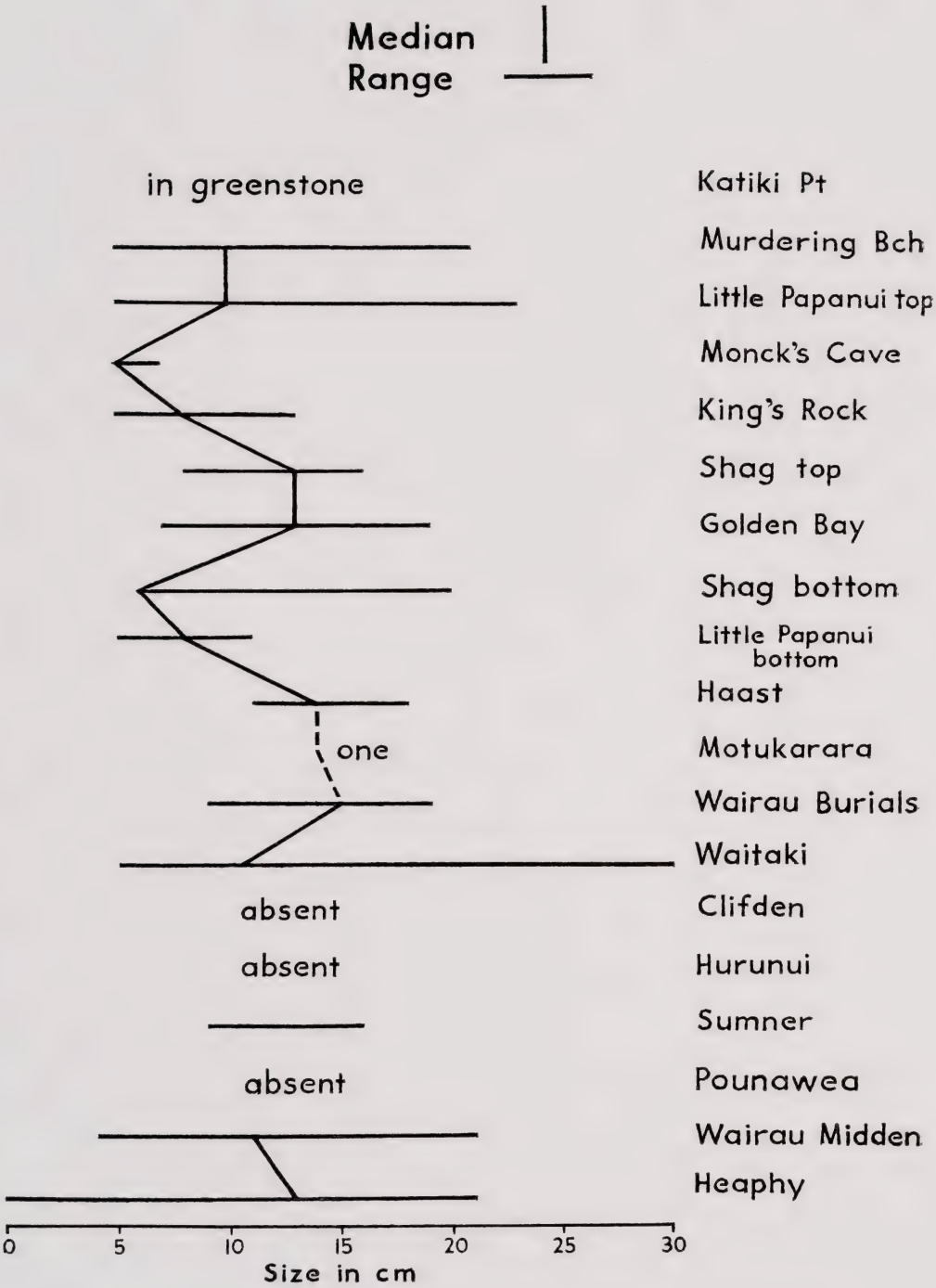


Fig. 37. Median and length range of quadrangular no grip adzes (not nephrite).

The percentage distribution and size range data would suggest that the variations in the triangular and quadrangular gripped forms correspond with the formative, maturity, decline and death in the life of an artifact group (Clarke 1968, p. 275). It is noted that the stages begin with the formative stage and that the birth of the artifact class is not represented in these graphs. The initial stages of this series of adze groups must be sought outside the South Island. By contrast the quadrangular ungripped group, has its birth in the lower section of the graph but does not proceed through its mature stage into a decline. Rather the item is replaced by one of European origin. On this evidence the collections represented here could be placed in their major groups according to the dominant adze groups (Table 4). In a New Zealand-wide study South Island adzes would start at Group 2, with Group 1 belonging to the "birth" stage.

It is worth noting here that the analysis indicates that at Wairau Bar the Burial layer could be much later than the Midden layer. Presumably this is true because here we are dealing with two excavated assemblages. A closer look at the Burial adzes, as recorded by Duff (1956), indicates that the burials do not all belong together, if the criterion of length range is valid. An attempt to resolve this problem is given in Fig. 38 showing the size range of adzes associated with the burials, as recorded by Duff (1956), checked against the recorded associations. The differentiation in associated artifacts and in length range strongly indicates that the burials do not belong strictly to one status group or perhaps even to one time period. The effect of mingling of various periods is to suppress the dominants and this is shown in the recording of the total number of adzes from Wairau Bar as in the bottom lines of Tables 2 and 3. I would suggest, however, that the position of the Burial and Midden adzes (Table 4), with the Burial adzes later, is a true one for the majority of the burials.

Flake Tools

Flake industries in the South Island belong to two main traditions, the 'awl' and the 'blade' industries. The awl industry of the Southern Cook Strait region (Figs. 39-42) and the equivalent awl industry of Foveaux Strait (Figs. 43, 44) are based on the occurrence of argillite in each area. F. V. Knapp described many of the Southern Cook Strait forms in 1924, 1928 and 1941. These industries have not been included in this paper as they will be the subject of a future paper.

The other tradition can be called the blade industry, which utilized ortho-quartzite or silcrete. This industry is distinguished as having a "technical sophistication" not found in the North Island (Shawcross 1964, p. 23). The typical tool is a parallel sided or leaf-shaped blade as described by Skinner & Teviotdale in 1927 for Shag River (Figs. 45-48). This industry is centred on Otago, but occurs as far south as Pahia. South from the South Otago sites, the blade industry is intermingled with elements of the Foveaux Strait awl industry, which gradually dominate the flake assemblages the further south the sites are. In South Otago the blades are made from mudstone and opal jasperoids as well as silcrete.

Blades are well represented in the Canterbury area but become less common in silcrete in the sites nearer Marlborough. In the Wairau Bar site there are only five silcrete blades, the rest being in chert. This attenuation of the industry in silcrete, in one sense, represents distance from the known quarry areas in Central Otago and South Canterbury. There is no known source of silcrete in the northern area. The awl tradition of S. Cook Strait appears in the Sounds. The intermingling phenomenon noted for South Otago does not appear to be evident.

Table 4. Grouping of sites containing adzes.

	Southland	South Otago	Otago	North Otago	Canterbury	Marlborough	Nelson	West Coast
Group 4			Murdering Beach Tarewai Pt Little Papanui top	Katiki	Moa Bone Pt Cave, upper Monck's Cave			
Group 3	Orepuke	King's Rock	Sandfly Bay Little Papanui mid	Shag River top	(Monck's Cave)		Golden Bay	
Group 2	Pahia Tokanui Mouth	Papatowai	Little Papanui bottom	Shag River bottom Waitaki River 1 Waitaki River	Pareora River Motukarara Rakaia River	Wairau Bar Burials		Haast
Group 1	Clifden	Pounawea			Hurunui Sumner	Wairau Bar Midden		Heaphy

( ) Alternative placement

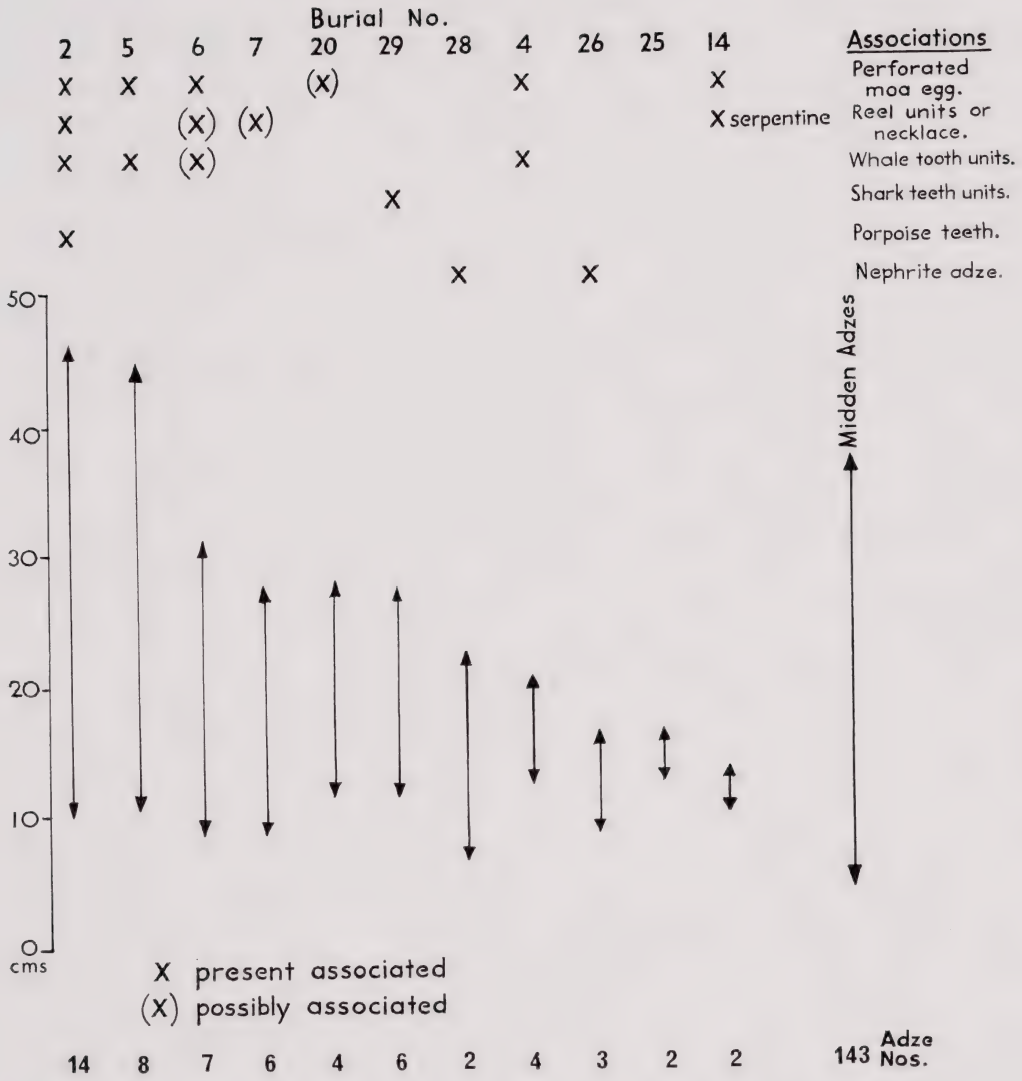
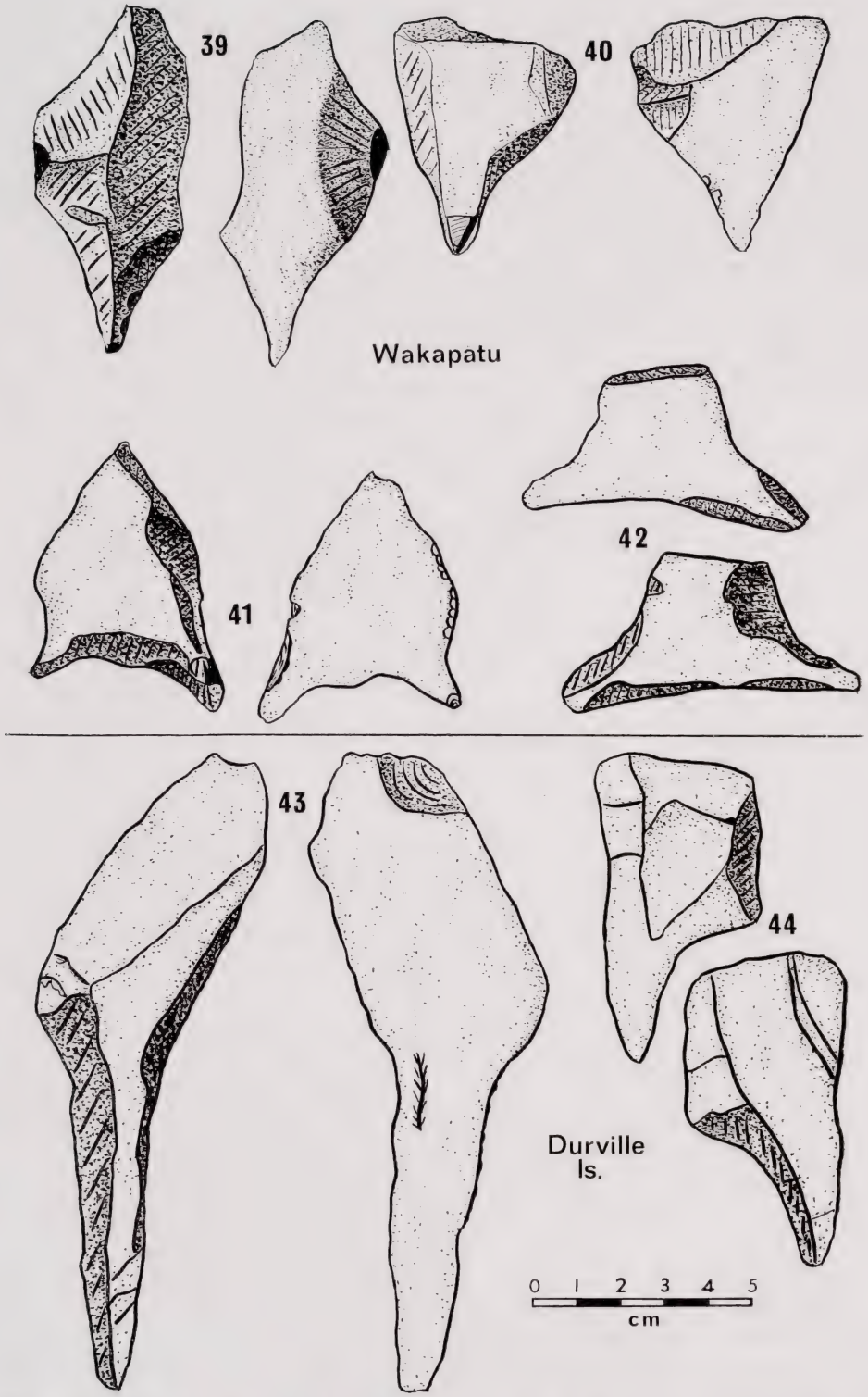


Fig. 38. Length range of adzes associated with Burials, Wairau Bar (Duff 1956).

In the blade industry secondary retouch can be from one or both sides, or one side of the blade may be left thick to produce a "backed blade" (Skinner & Teviotdale 1927). It was found in the preliminary analysis that secondary forms were local in time and space and were often confined to one layer or a site while the parallel sided blades as defined here were not. A selection was made of those basic forms which had chronological significance based on the technological expertise required to produce them. In terms of this, the classes or forms are as follows.



Figs. 39-44. Typical 'awl' flake tools. 39-42. Foveaux St. (Wakapatu). 43-44. Southern Cook St. (Durville I).

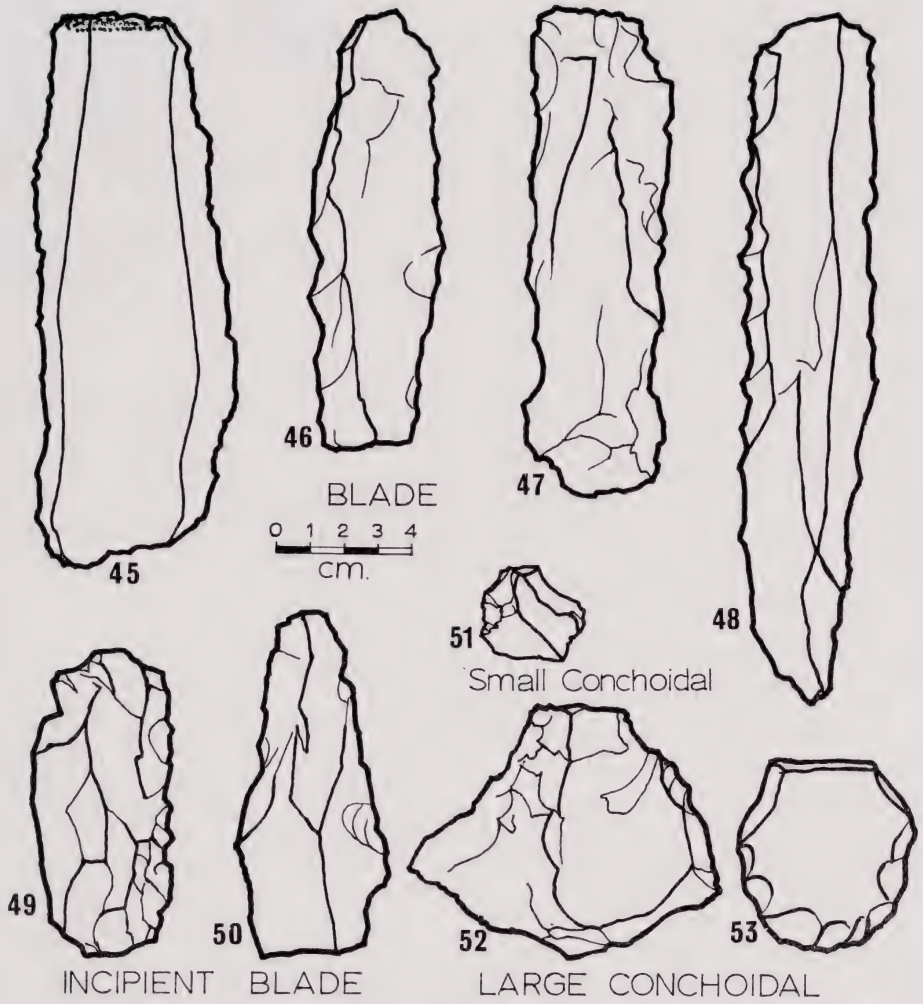
1. Blade (Figs. 45-48)
   (a) Parallel sided or leaf shaped with length 2½ plus times width across the bulb of percussion.
   (b) Struck off a prepared hammer dressed or finely flaked striking platform which is at 60° to 90° to the angle of the blow.
   (c) Struck off the core with a single blow and not reshaped after the original blow. Thin in proportion to length.
   (d) Modified with edge retouch on one or two sides, usually on two sides.
   (e) Retouched from one direction to produce biased edge or two directions to produce saw edge.

2. Incipient blade (Figs. 49, 50)
   (a) Irregular in shape but approximately the leaf shape with length about twice width across bulb of percussion (width).
   (b) Struck off a roughly flaked platform placed 45° to 90° to angle of blow. On some examples the platform is at a negative angle to the blow.
   (c) Struck off the core then thickness reduced with subsequent blows but blade still thick in proportion to length.
   (d) Modified with edge retouch on one or two sides.
   (e) Retouch from one or occasionally two directions.

3. Large conchoidal or chopper (Figs. 52, 53)
   (a) Shaped like a scallop shell, measuring more than 5cm wide at the bulb of percussion.
   (b) Struck off a roughly flaked platform 45° to 90° to the angle of strike.
   (c) Struck off core with single blow. Thick in proportion to total length.
   (d) Modified with edge retouch usually on central third of curve but may include whole curved surface.
   (e) Retouched from one direction.
   (f) Butt (or striking platform) area may be modified by flaking to make hand gripping more comfortable or to produce surfaces to take a lashing if lashed longitudinally on a stick handle.

4. Small conchoidal flake (Fig. 51)
   (a) A small shell-shaped instrument or somewhat irregularly shaped conchoidal fracture measuring less than 5cm across the flake at the bulb of percussion.
   (b) Struck off a platform prepared by fine flaking, hammer dressing or previous flake scar, with a single blow.
   (c) Edge retouch applied if thickness too great to give a good cutting edge. Otherwise retouch seems to be mainly the product of use.

5. Miscellaneous flake or waste flake
   (a) Irregular shaped waste flakes.
   (b) May be modified by edge retouch in some cases for use.
   (c) No regular striking platform.



Figs. 45-53. Typical 'blade' flake tools of Otago (Little Papanui bottom layer).

RESULTS OF ANALYSIS

Tables 5 and 6 show the percentage and numerical distributions of these forms in the sites.

Preliminary analysis of sample collections from two early and two late sites suggested that the length range of flakes taken overall was important. Figure 54 illustrates this point from the two early sites of Waitaki River and Shag River, and the two late sites of Little Papanui (top layers) and Murdering Beach (classic). This indicated that there was a chronological differentiation in the flake material from the two sets of sites as the graph has a clear bimodular shape with Waitaki and Shag peaking at about the 10cm length, while Little Papanui and Murdering Beach peak at 4cm. These sample collections were a random selection with no differentiation into forms or classes. Table 7 takes the same two sets of sites using different random samples. Length is

rendered in groups plotted against percentage distribution within the sizes. Again, the distribution is quite distinct. This analysis was undertaken to determine the significance of the numbers of broken pieces. Shawcross has suggested (Shawcross 1964, p. 21) that flake blades were blanks which were then snapped into sections. If this were so then the proportion of complete to broken blades should reflect this position with complete flake blades being much less common in proportion to the total of broken blades. As will be seen from Table 7, in the Waitaki and Shag River sites where blades are present in great numbers, the proportion of complete to broken flakes in each case mirrors the complete distribution. Breaking of flakes is a reflection of length, not of deliberate policy.

Table 5. Percentage distribution of flake tools.

	Blades	Incipient blades	Large conchoidal	Small conchoidal	Waste	Total numbers	Median blade size (cm)	Remarks on collection
Katiki Pt	5	.	13	60	24	45	5	Excavated (Trotter)
Long Beach	5	.	.	95	.	250	4	Top layer site
Murdering Beach Classic	12	.	.	74	14	100	4	
Kaikai's Beach, top layer	17	.	.	74	9	400	5	Lewis Collection attributed to top
Little Papanui, top layer	16	10	.	58	16	250	4	All that can be attributed
Monck's Cave	40	27	2	21	10	52	6	Probably mixed
Little Papanui, middle layer	45	15	3	30	7	177	4	All that can be attributed
Bromley	4	.	.	74	7	130	5	Excavated
Kyeburn	28	4	28	20	20	30	6	Single site, Danzies Pass
Anderson's Bay	35	20	2	21	22	52	6	Excavated, some mixture
Tai Rua	42	5	4	33	16	100	7	Excavated, all layers
Matarae	74	20	.	.	6	40	8	Shelter, total collection
Moa Flat	40	20	3	11	26	35	6	On Clutha River
Onepoto	53	3	10	34	0	100	8	A little mixed, = Pipikaretu
King's Rock	50	8	.	20	22	24	9	All layers
Cannibal Bay	58	18	.	25	1	12	9	All layers, surface
Murdering Beach, Moa-hunter	22	18	10	28	22	45	12	Site on back dunes
Shag River, bottom layer	74	9	13	.	4	350	12	All that can be attributed
Nenthorn	30	25	12	4	29	24	12	Quarry
Rakaia River	21	16	6	23	34	118	11	Mixed layers
Kaikai's Beach, bottom layer	47	10	3	40	.	200	8	Identified by peat staining
Little Papanui, bottom layers	41	22	6	23	8	500	11	Excavated
Oturehua	25	25	3	16	31	78	11	Quarry site, top layer
Wairau Bar Midden	34	18	18	20	10	108	7	In chert
Pleasant River	30	8	3	19	40	170	11	Excavated but all layers
Pareora River	10	8	12	21	9	508	9	Probably selected
Pounawea	46	21	9	11	12	75	7	Mainly bottom two layers
Papatowai	34	25	14	13	14	160	8	All layers, mainly bottom
Waitaki River	32	20	14	24	10	778	7	? mixed layers
Sumner	30	23	5	35	0	48	6	? mixed layers
Gray's Hills	6	33	30	2	29	100	6	Probably selected

Table 6. Numerical distribution of flake tools.

	Blades	Incipient blades	Large conchoidal	Small conchoidal	Waste	Total numbers
Katiki Pt	2	0	5	28	10	45
Long Beach	13	0	0	237	0	250
Murdering Beach Classic	12	0	0	74	14	100
Kaikai's Beach, top layer	68	0	0	296	36	400
Little Papanui, top layer	40	25	0	145	40	250
Monck's Cave	20	14	1	11	6	52
Little Papanui, middle layer	80	26	5	53	13	177
Bromley	6	8	1	108	7	130
Kyeburn	8	1	8	6	7	30
Anderson's Bay	18	10	1	11	12	52
Tai Rua	42	5	4	33	16	100
Matarae	29	10	0	0	1	40
Moa Flat	19	7	1	4	4	35
Onepoto	53	3	10	34	0	100
King's Rock	12	2	0	5	5	24
Cannibal Bay	7	2	0	3	0	12
Murdering Beach, Moa-hunter	10	8	5	12	10	45
Shag River, bottom layer	259	31	45	0	15	350
Nenthorn	7	6	3	1	7	24
Rakaia River	25	19	9	27	38	118
Kaikai's Beach, bottom layer	94	20	6	80	0	200
Little Papanui, bottom layers	205	110	30	115	40	500
Oturehua	32	7	3	5	31	78
Wairau Bar, Midden	39	19	19	20	11	108
Pleasant River	51	13	6	32	68	170
Pareora River	47	241	66	104	50	508
Pounawea	35	16	7	8	9	75
Papatowai	54	39	22	21	24	160
Waitaki River	245	156	105	272	0	778
Sumner	18	11	2	17	0	48
Gray's Hills	6	33	30	2	29	100

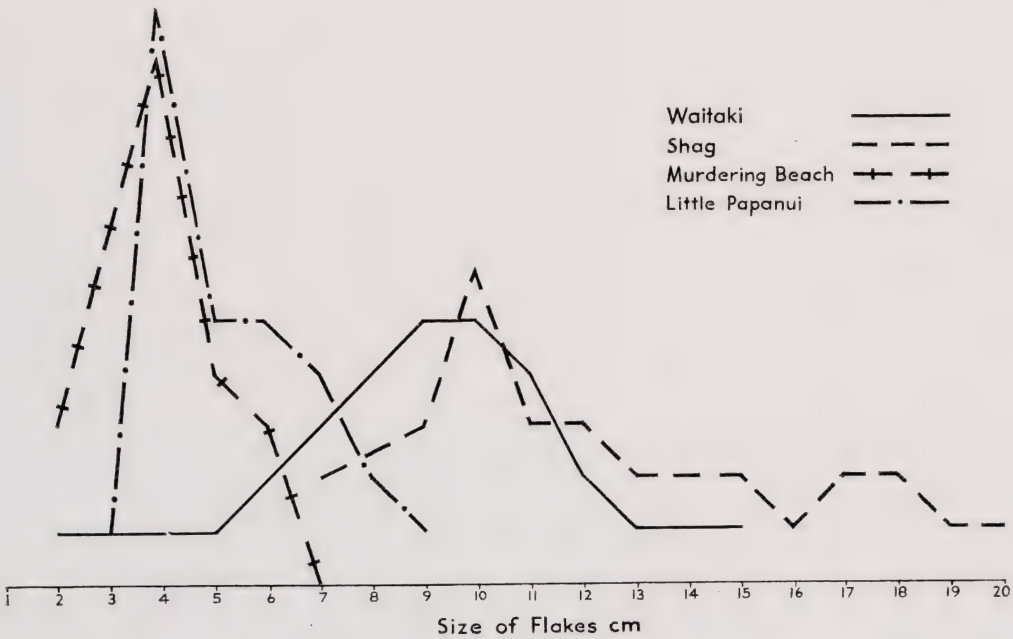


Fig. 54. Size distribution of typical sample collections of flake material.

Table 7. Length distribution and breakage of flake tools in four sites.

Site	Nos. of flake tools	Length range 1 - 5cm	6 - 10cm	11 - 15cm	16 - 20cm	Total Percentages
Murdering Beach	92	76% complete 19% broken	3% complete 2% broken			79 21 100
Little Papanui	487	72% complete 6% broken	20% complete 2% broken			92 8 100
Shag River	173	17% complete 6% broken	38% complete 11% broken	14% complete 5% broken	7% complete 2% broken	76 24 100
Waitaki River	256	20% complete 9% broken	53% complete 15% broken	2% complete 1% broken		75 25 100

In Figs. 55-57 and Tables 5 and 6 the sites are arranged in order according to the total profile displayed by the proportional distribution of the flake tool classes, e.g. in Fig. 55 classes 2 and 3 are well represented, in Fig. 56 class 1, leading to Fig. 57, where class 4 dominates. The significant chronological distinction is between total proportion of blades and of small conchoidal flake. In these terms, Fig. 58, which has been ordered as for Table 5, illustrates the complementary distribution pattern displayed by the percentage distribution of these two forms.

Blades as a group seem to follow the birth, maturity, death or Clarke's "threshold, formation, coherent, post-coherent, threshold" (Clarke 1968, p. 225) sequence. This is evident in the graphs and is also very clearly demonstrated in Fig. 59, which records length range of complete blades in the sites arranged in the same order as in Table 5. There are anomalies, but in general the length range reflects the life of this form especially when arranged, as here, according to the percentage distribution of the form. All the sites at the beginning of the graph have less than 50% blades (usually 30-40%). Sites in the middle of the graph where the size is greatest have up to 75% blades. Sites in the declining group generally have less than 50% blades, while the last group have less than 40% blades.

A further criterion which can be employed is technical expertise. Sites in the first group have less well-made blades than those in the second, third or fourth. This criterion, if employed, actually removes most of the anomalies in the present series.

A computer programme in which all variables can be analysed is an ideal solution. B. F. Leach, in an important study (Leach 1969) has been able to use such a programme for four major sites — Karitane A, Riverton, Wakapatu and Oturehua. Similarity was closest between Oturehua and Riverton. Oturehua is a silcrete quarry and working floor dated to A.D. 1023 $\pm$ 82 and 1053 $\pm$ 27 (Leach 1969, p. 72). Riverton is an exploitation site of a locally occurring green argillite and has intense industrial activity in adze-making. The sample used in Leach's study was in direct association with charcoal, which gave a date of A.D. 1402 $\pm$ 39 (1969, p. 66). Closest to these two was Wakapatu, a midden site with argillite flakes of awl type and adze pieces dated to *c.* A.D. 1270. A smaller assemblage from Pleasant River shared features with Oturehua and Karitane, the latter a classic Maori site of *c.* A.D. 1800.

It has been argued in an earlier paper (Simmons 1967) that if the blade industry of Murihiku developed in New Zealand then it could have been derived from common Polynesian adze-making techniques. To take this a stage further, any culture group with the knowledge of flaking as an adze-making technique such as Polynesia was able to produce flake tools as required or to use adze waste flakes if needed for this purpose. The deliberate production of long parallel blades, as in the quartzite blades of Otago and the chert or obsidian blades of the Solomons (Auckland Museum), the argillite awls of Cook Strait, Foveaux Strait and the basalt awls and occasional blades of Pitcairn, required a slight, but not very marked, technological change. The similarity of these various industries does not necessarily imply direct contact but it may do so. The closeness of Riverton, an adze manufactory, and Oturehua, an early silcrete blade quarry, suggests that the two technologies are not all that far apart.

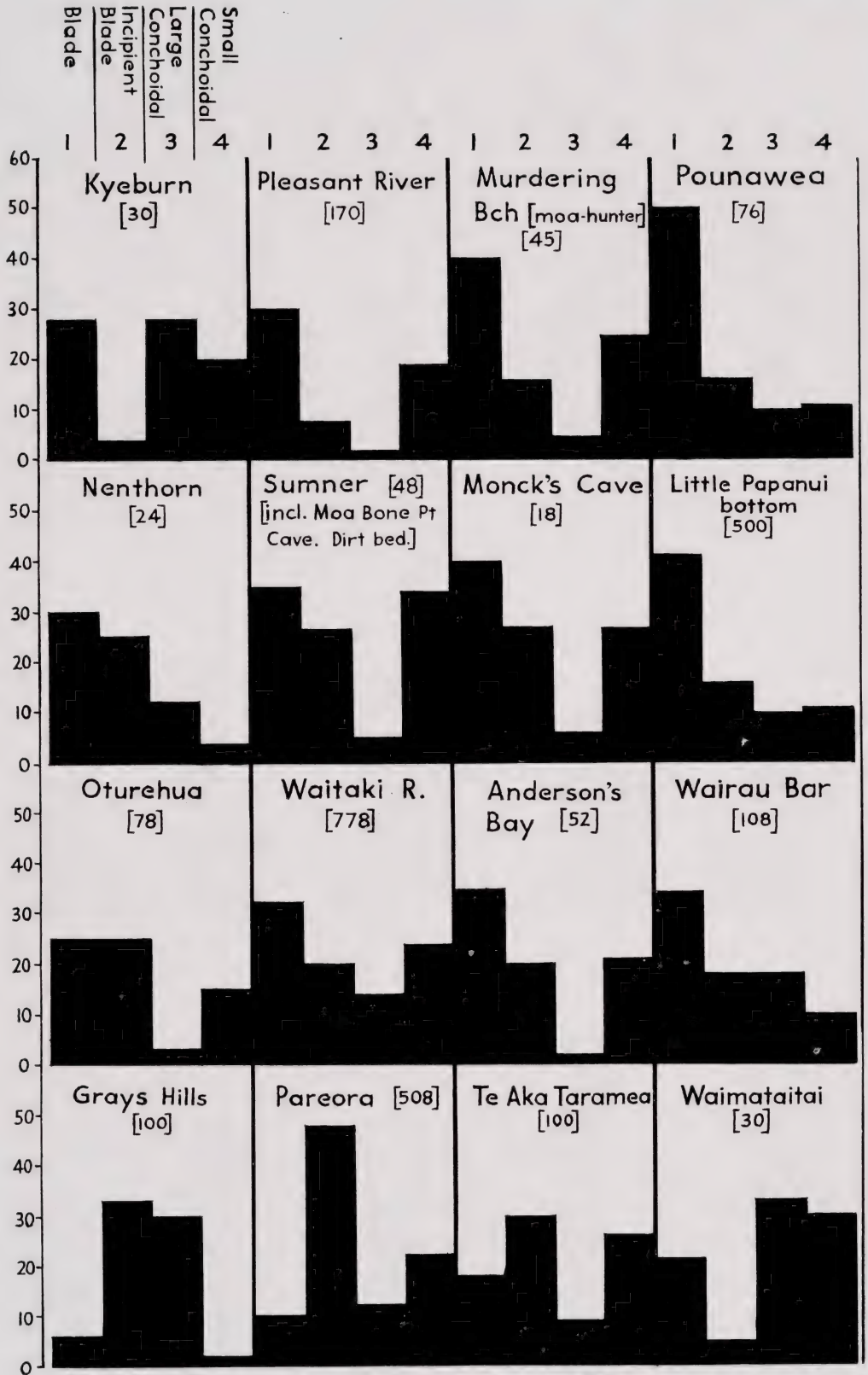


Fig. 55. Percentage distribution of flake tool classes. Part 1. From Class 2 and 3 dominant to Class 1 dominant.

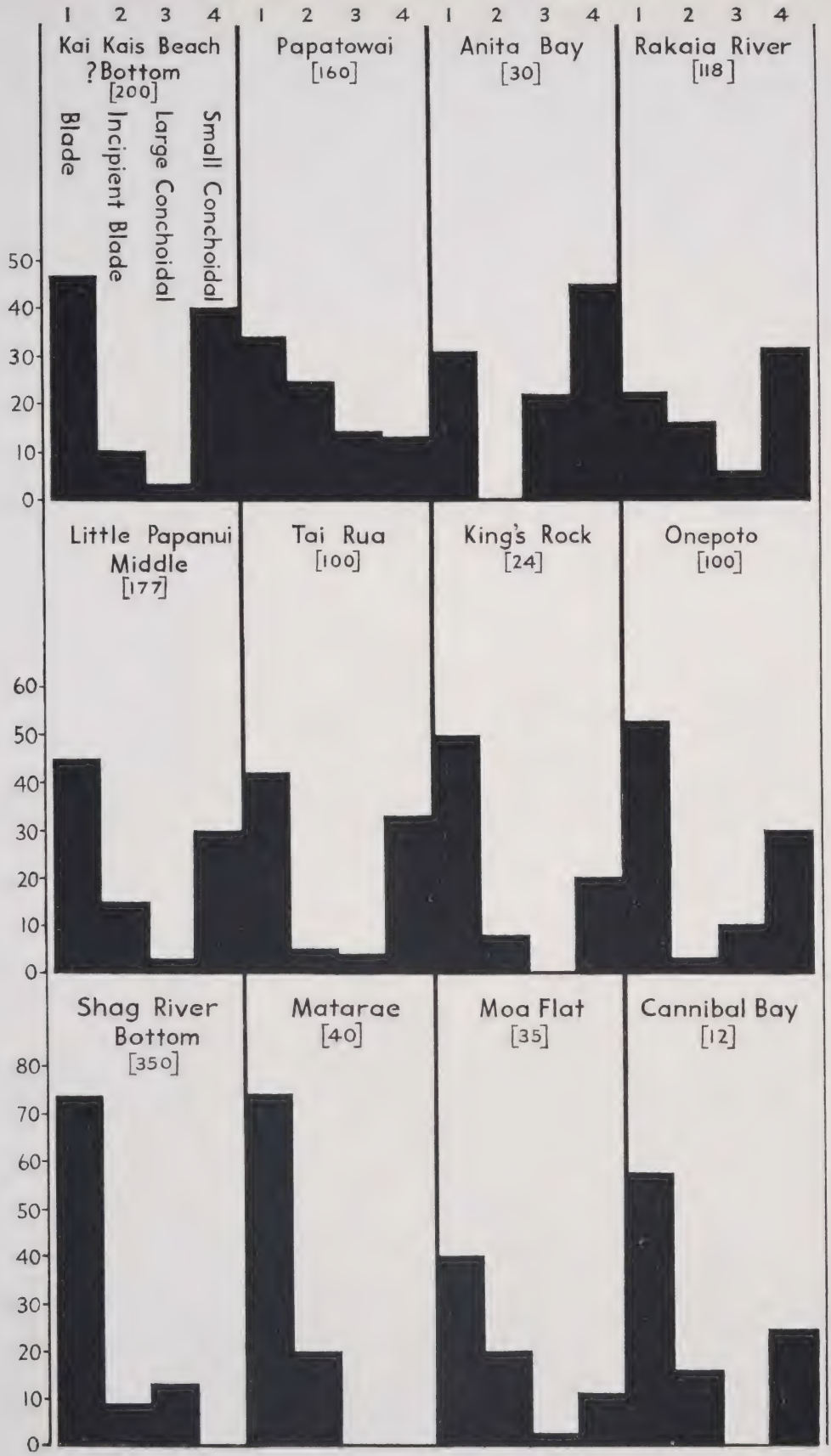


Fig. 56. Percentage distribution of flake tool classes. Part 2. From Class 1 dominant to Class 4 dominant.

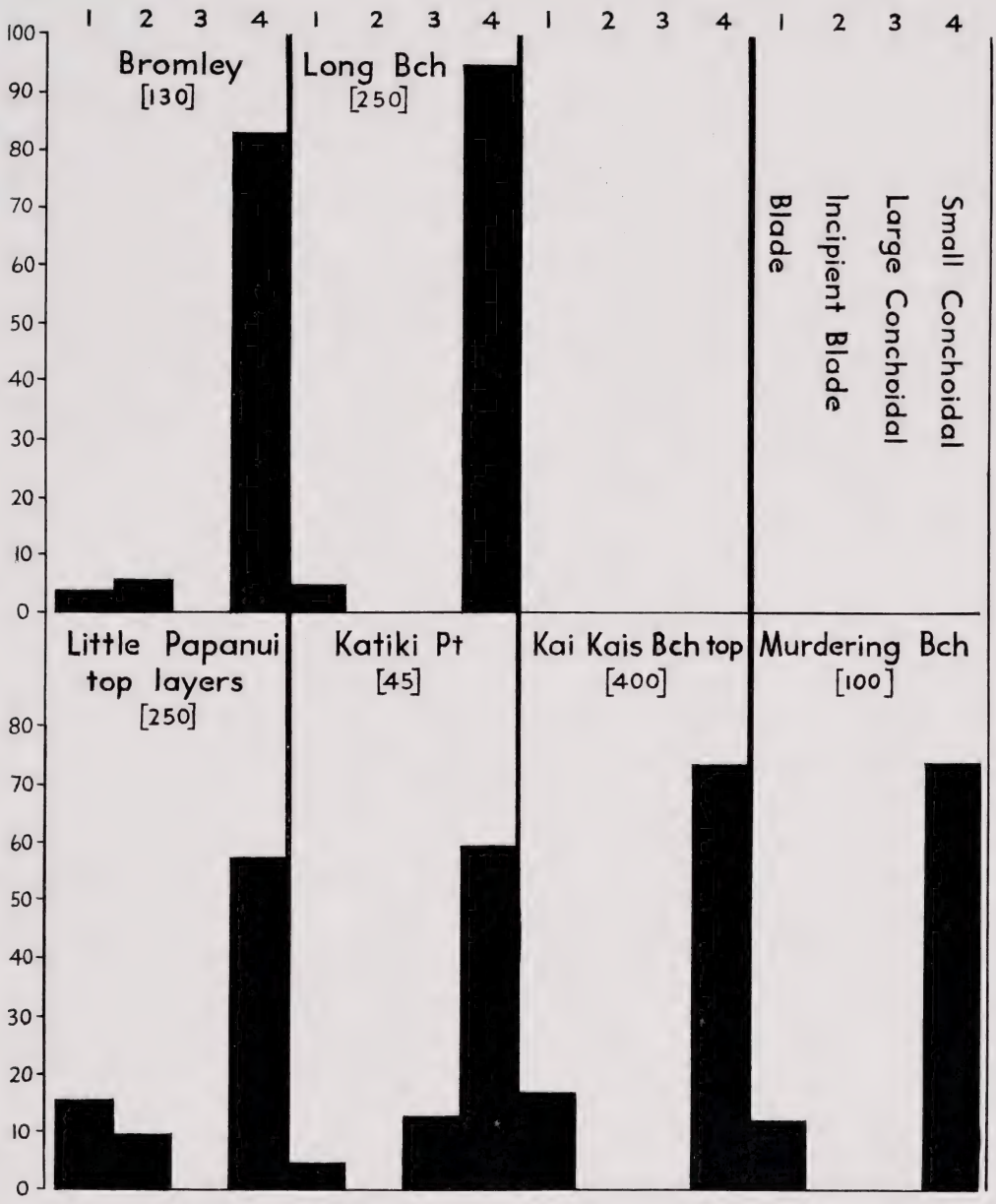


Fig. 57. Percentage distribution of flake tool classes. Part 3. Class 4 dominant.

Leach suggested that Murihiku culture history is a continuous one from earliest to latest with the greatest period of technological change in the 14th century. ". . . the initial settlement was followed by an accelerating rate of technological change, reaching its peak in the 14th century and resulting in the decline rather than the development of this specialised industry in Murihiku." (Leach 1969, p. 138). The flake technology of the Classic Maori sites in Murihiku is a continuation of the flake industry of the earlier periods, indicating a cultural absorption.

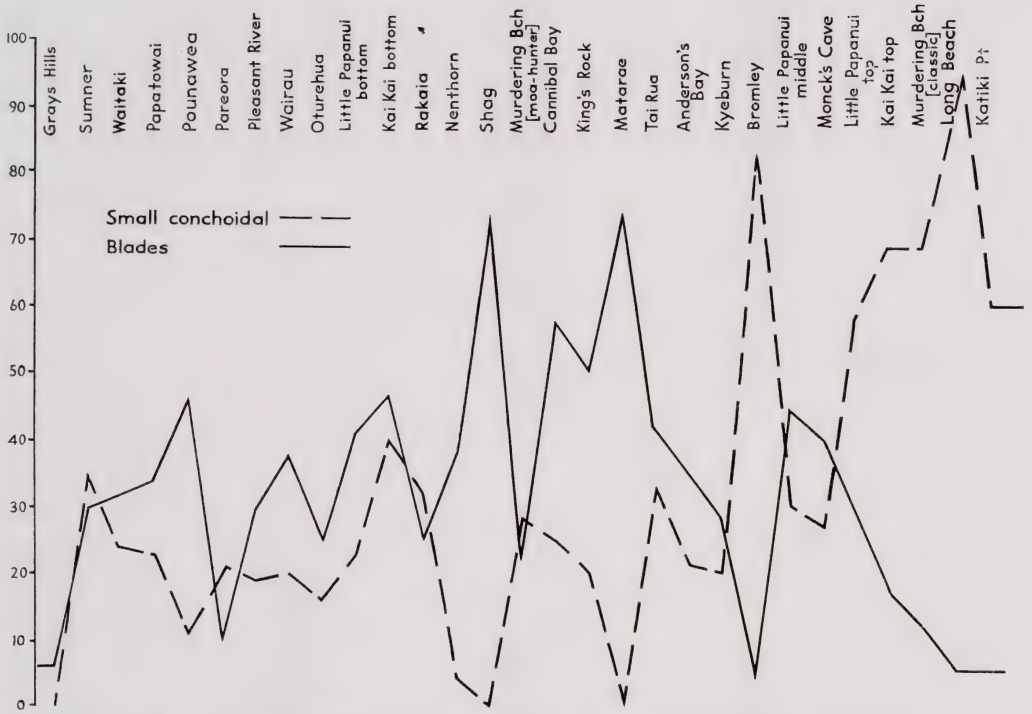


Fig. 58. Percentage distribution of blades and small conchoidal flake compared.

Figures 55-58, Table 5, and Fig. 59, suggest that the sites containing flake tools can be grouped. Whether the relationship of one site to another is simple or complex, or whether the network of relationship is in three dimensional form, or not, cannot really be determined in a fairly simple study of this kind. All that can be stated is that sites appear to stand in certain relationships to each other, the exact definition of which must await further study.

Groupings for length range (Group 1, length up to 17cm long; Group 2, length up to 26cm; Group 3, up to 16cm; Group 4, up to 7cm) and for percentage distribution are given in Tables 8 and 9.

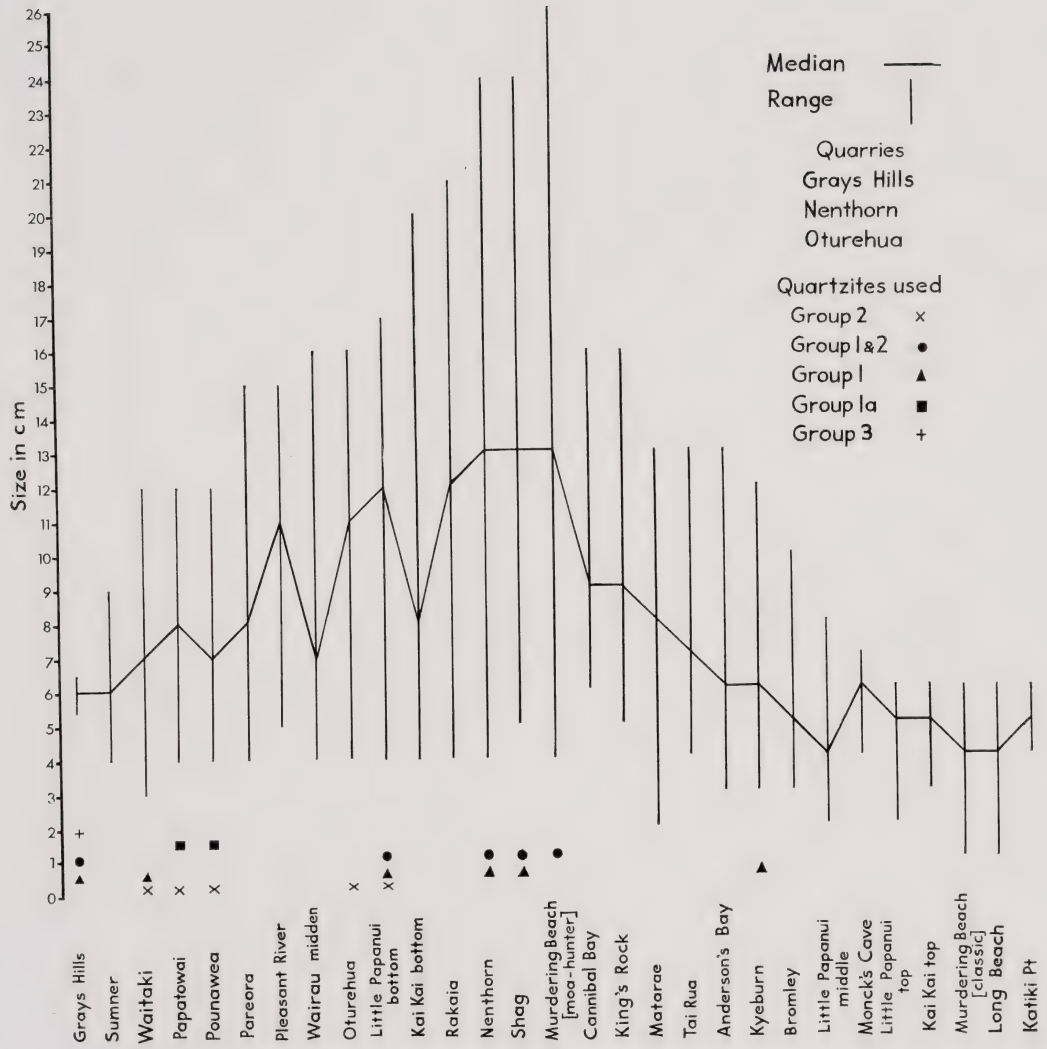


Fig. 59. Length range and median of *complete* flake blades.

Table 8. Grouping of sites by area and length range of flake tools.

	Southland	South Otago	Otago	North Otago	Canterbury	Marlborough
Group 4*			(Karitane) Murdering Beach Kaikai's, top Little Papanui top	Katiki Pt Monck's Cave		
Group 3		King's Rock Cannibal Bay	Little Papanui mid Anderson's Bay Matarae	Kyeburn Tai Rua (Pleasant R)	Bromley	
Group 2	(Wakapatu)		Murdering Beach, Moa-hunter, b Kaikai's bottom	Shag R b, c Nenthorn, b, c	 Rakaia R	
Group 1	(Riverton)	Pounawea, a, d Papatowai, a, d	Little Papanui bottom, a, b, c	(Ototara) Oturehua, a Pleasant R Waitaki R a, c	Pareora R Sumner Gray's Hills, b, c	Wairau Bay Midden

* Group 4, —7cm; Group 3, —16cm; Group 2, —26cm; Group 1, —17cm
( ) Leach 1969 — basis for placement
a, b, c, d quartzite group used (Simmons & Wright 1967)

Table 9. Grouping of sites by area and percentage distribution of flake tools.

	Southland	South Otago	Otago	North Otago	Canterbury	Marlborough
Group 4			Long Beach Murdering Beach Kaikai's, top Katiki Pt Little Papanui top		Bromley	
Group 3		Papatowai King's Rock Cannibal Bay	Kaikai's, bottom Anita Bay Little Papanui mid Onepoto Matarae Moa Flat	Tai Rua Shag R	Rakaia R	
Group 2		Pounawea	Murdering Beach Little Papanui, bottom Anderson's Bay	Kyeburn Pleasant R Nenthorn Waitaki R Oturehua	Monck's Cave	Wairau Bar Midden
Group 1				Waimataitai	Te Aka Tarewa Pareora R Gray's Hills	

Here two sets of grouping show quite clearly the problems associated with museum, surface and mixed collections. Depending on which set of criteria are used, the apparent grouping of sites or collections changes. This is due to the mixing of layers which shows up in those graphs (Figs. 55-58) and the table (Table 9) orientated to percentage distribution. In the length range (Fig. 59), sites which are early have small blades and a less sophisticated technology for producing them. In the very late sites, blades are rare and small, produced by a superb technology.

In the sites of the periods between, the blades become sophisticated and increase markedly in size, then the blades decrease in size though the technology remains. The distinguishing characteristic separating the early and these later sites is not blade size but technology.

Secondary characteristics are the greater proportion of small conchoidal flake in the later sites and the almost complete absence of the other flake-tool classes.

With these criteria it is possible to overcome, to a certain extent, the effects of mixing in collections of flake material and to suggest that the various groups should be as in Table 10. The percentage distribution table (Table 9) and graphs (Figs. 55-58) also indicate that sites with mixed populations of flake material were occupied also at a later or earlier period than the main one and such alternative or complementary groupings are placed in parenthesis in Table 10.

Table 10. Grouping of sites by area and sequence of flake tools.

	South Otago	Otago	North Otago	Canterbury	Marlborough
Group 4		Karitane Murdering Beach Kaikai's Beach top Little Papanui top	Katiki	Monck's Cave Bromley	
Group 3	King's Rock Cannibal Bay (Papatowai) Moa Flat	Little Papanui middle Anderson's Bay Onepoto Matarae	Tai Rua Kyeburn (Shag R)	(Rakaia R)	
Group 2		Murdering Beach Moa-hunter Kaikai's Beach bottom Little Papanui bottom (Anderson's Bay)	Shag R Nenthorn Pleasant R (Waitaki R) (Oturehua)	Rakaia R (Monck's Cave) (Sumner)	(Wairau Bar)
Group 1	Pounawea Papatowai		Oturehua Waitaki R Waimataitai	Sumner Gray's Hills Pareora River	Wairau Bar

( ) alternative or complementary placement

Fishhooks

Fishhooks for the southern area of the South Island were studied in 1967 by Hjarno (Hjarno 1967) and in a later study in the same year (Simmons 1967). In this analysis the major groups of fishhooks only have been taken together to illustrate the evolutionary trends. These groups are as follows.

1. One-piece bait hooks of all forms including Hjarno types D1, D2, D3, D4.
2. Barbed composite bait hook points including simple points with outer barbs, reversed barbed points, serrated and multi-barbed points or Hjarno types C2, C3, C4, C5.

   These two groups are contrasted in Fig. 60.

4. Unbarbed composite bait hook points including small, long slender, and medium points of Hjarno type C1.
5. Lure hook points excluding barracouta hook points of Hjarno types B1, B2.

   These two groups are contained on Fig. 61.

6. Simple barracouta lure hook points of Hjarno Type 1 variety A.
7. Serrated and dog-leg barracouta lure hook points of Hjarno Type A varieties 2 and 3.

   These last two belong in the same period of time so are grouped to contrast with the simple form in Fig. 62.

Numerical distribution of these hooks has been published in detail in Hjarno's monograph (1967) and is not repeated here. Hjarno and Trotter (Trotter 1965b) have both clearly demonstrated the evolutionary trends expected in Otago fishhooks. In the present study only a few extra sites are included and additional hooks have been included without altering the tendencies already exhibited in the previous studies.

These are that:

1. One-piece bait hooks are common in early sites but are largely replaced by barbed points in late sites (Fig. 60).
2. Unbarbed points tend to become more common in the early to middle part of the range, then to become very uncommon. Lure hook points are commoner in the early part of the range (Fig. 61).
3. Simple barracouta points occur almost exclusively in the early part of the range but are accompanied by the two intrusive forms of dog-leg and serrated points in the later part of the range. The dog-leg and serrated points are also found in Hawkes Bay (Fig. 62).

There are various exceptions to these tendencies, but many would seem to reflect the effects of mixed provenance of a surface collection rather than true exceptions. However, the archaeological sites of North Otago suggest that regional variations will be of great importance in future studies. The sequence which emerges from the study of fishhooks in order is tabulated (Table 11) with the sites grouped in terms of the dominance of the various forms.

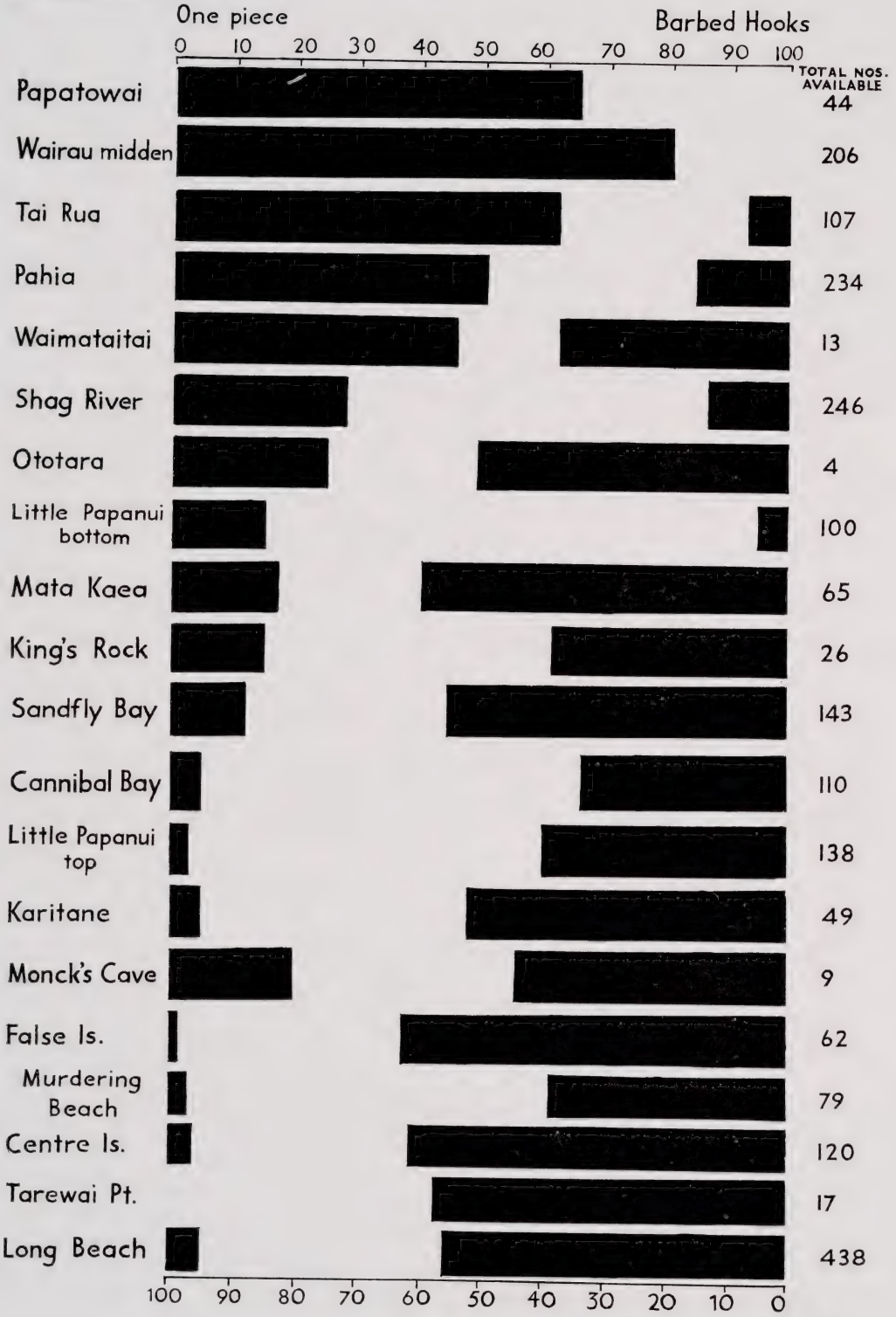


Fig. 60. Percentage distribution of one piece hooks and barbed hook points.

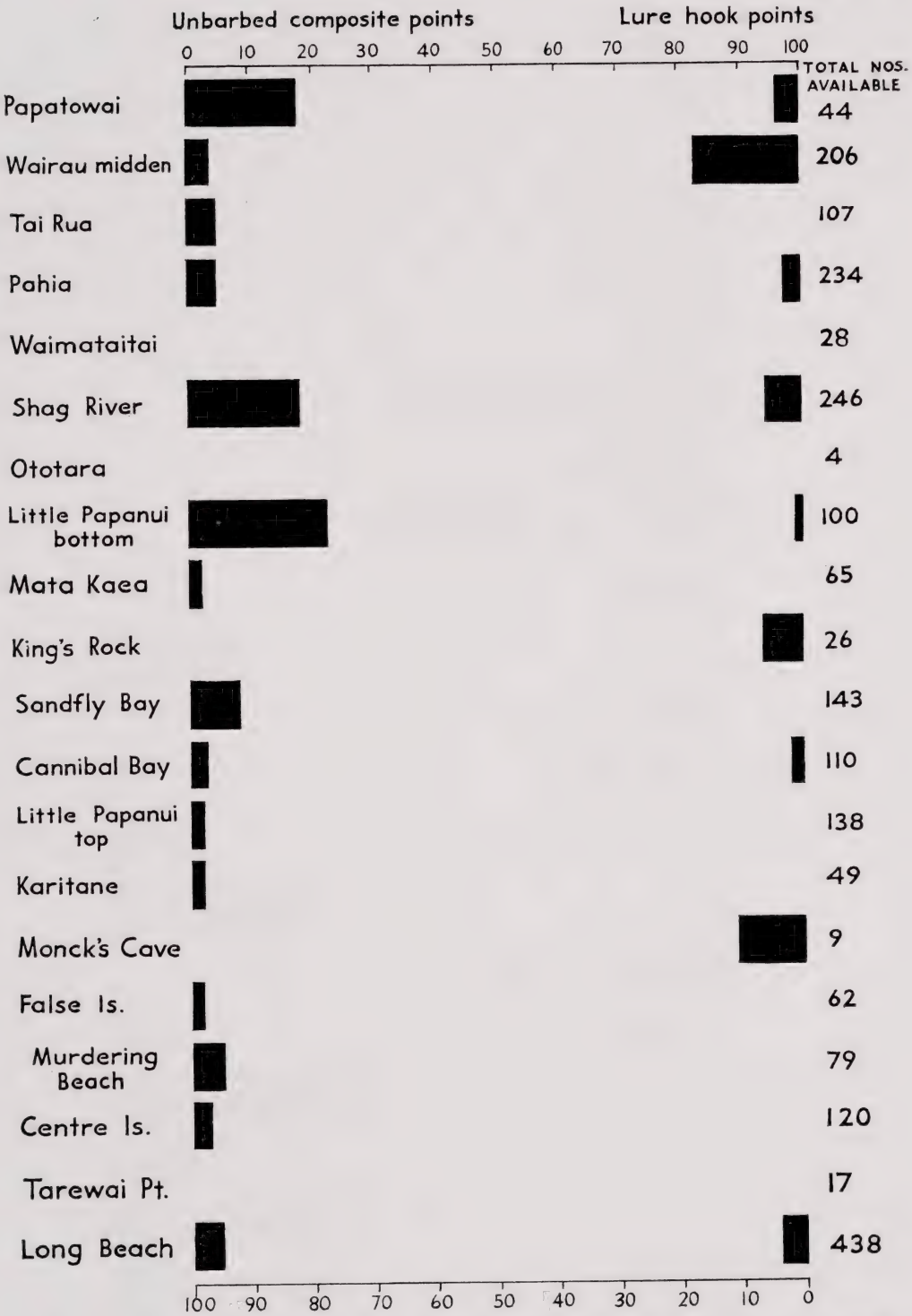


Fig. 61. Percentage distribution of bait hook points and lure hook points (excluding barracouta points).

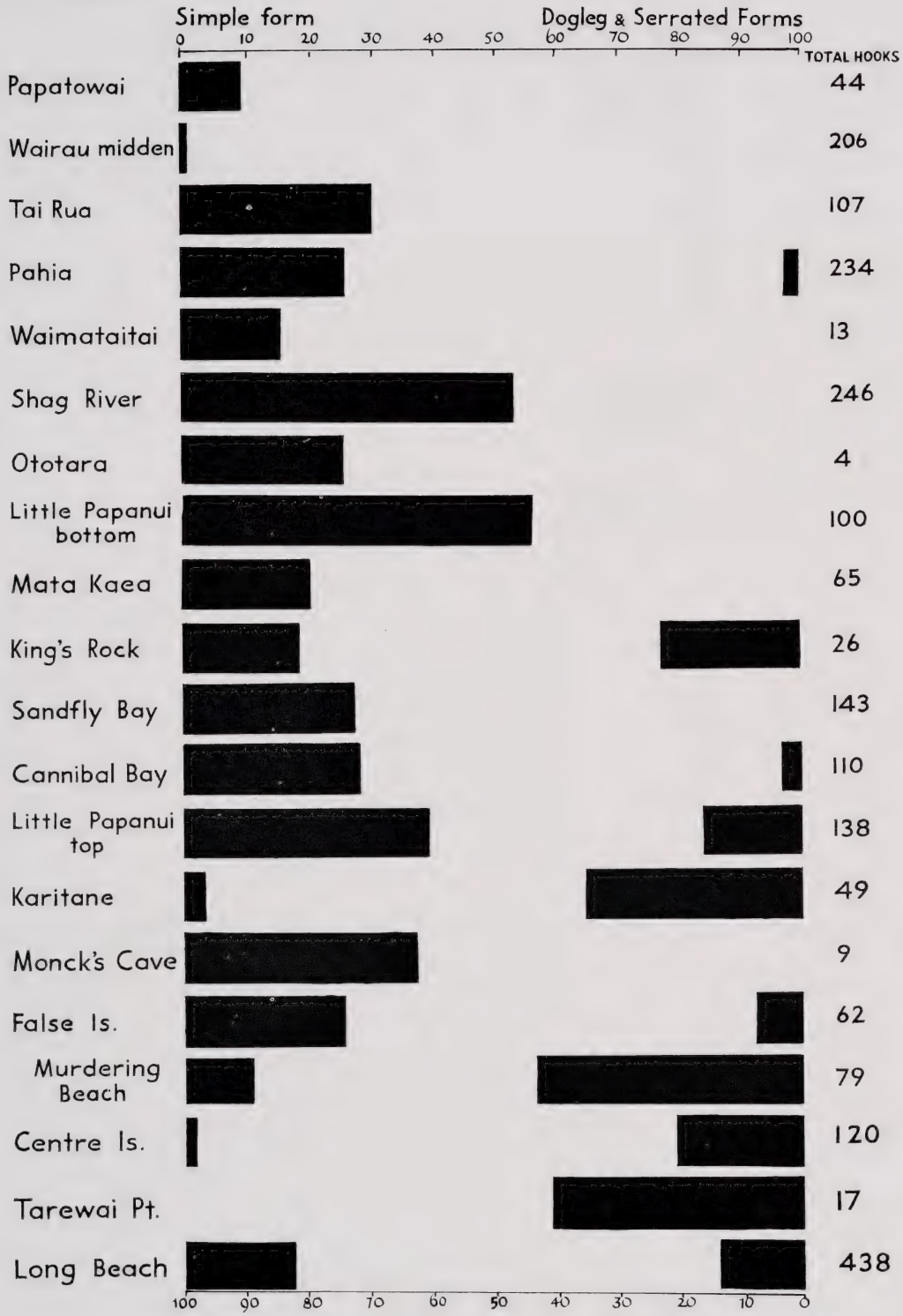


Fig. 62. Percentage distribution of simple, serrated and dogleg barracouta lure hook points.

Table 11. Grouping of sites by area and sequence of fishhooks.

	Southland	S. Otago	Otago	N. Otago	Canterbury	Marlborough
Group 4	Centre I	False I Cannibal Bay	Tarewai Pt Long Beach Murdering Beach Karitane Little Papanui top		Monck's Cave	
Group 3		King's Rock	Sandfly Bay	Matakaea		
Group 2	Pahia		Little Papanui bottom	Ototara Waimataitai Tai Rua		
Group 1		Papatowai				Wairau Bar

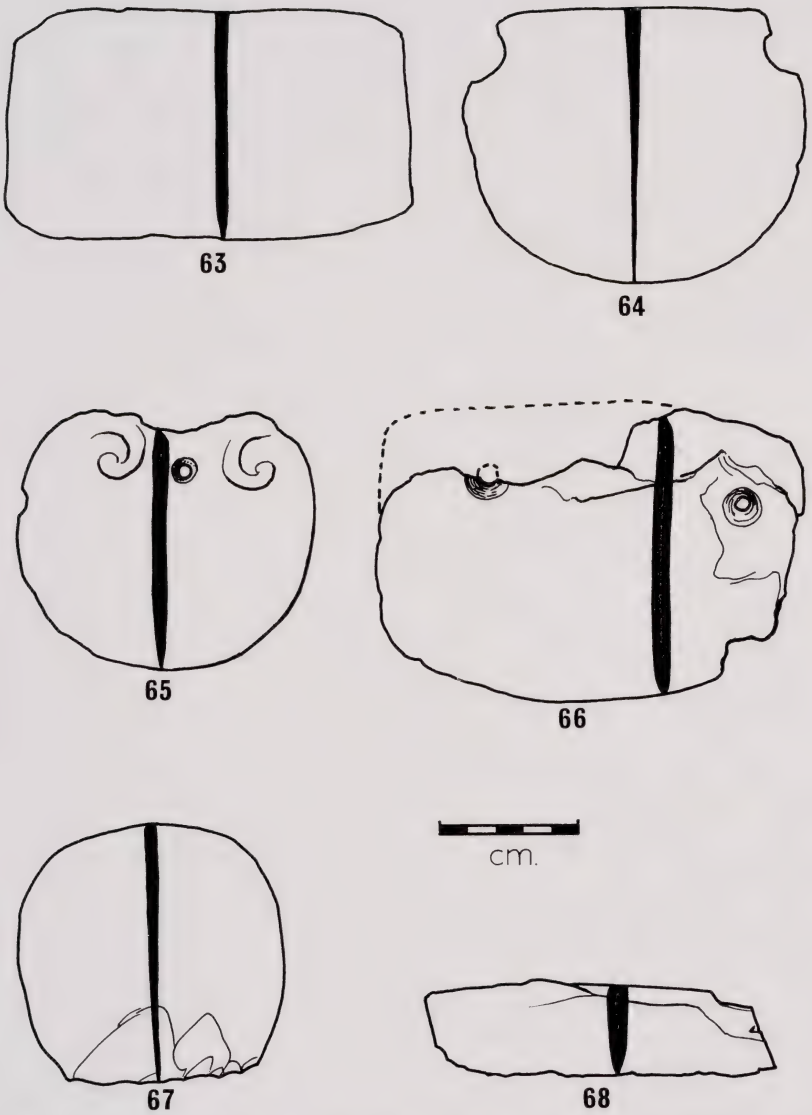
Artifacts forming Discontinuous Sequences

In Table 12 the site distribution of a number of items is recorded in so far as they are known from museum and private collections. These items are restricted in time and often exhibit a markedly regional distribution. Table 12 is not an exhaustive catalogue of all occurrences of these items. Trade beads and clay pipes are of European origin and are important time markers for the late sites. Unfortunately, because they are European they have often not been considered worthy of inclusion in collections. Patu, tiki, perforated human teeth, imitation human teeth, combs, kinky pendants, tattoo chisels, hei matau, greenstone pendants, toggles, flutes, barbed point pendants (a barbed fishhook point shape), are all mainly restricted to the later periods of prehistory. Some items, such as the small bird bone tube for a necklace, occur both in early and late sites but do not appear to be present in many intermediate sites. Carcharadon shark teeth perforated at the base, are used in the early period as ornaments but are recorded by Captain Cook as teeth on knives for cutting up human flesh. The other ornament forms, the imitation shark tooth, whale tooth unit, the whale tooth copy in stone, reels, *Dentalium nanum* shell beads, perforated cetacean teeth, seal teeth and divided sphere are restricted to earlier sites. The chevron pendant, which takes a number of forms, is extremely interesting and important, but seems restricted to the middle series of sites. Polished slate or stone knives (Figs. 63-68) commonly known as rectangular stone knives, or by the Eskimo name of "ulu", are found only in quantity in early sites and rather quickly become obsolete. This form, which has important implications for the prehistory of the Pacific Basin, is so far restricted entirely to the South Island and is one indication of the possible multiple origins for the settlement of New Zealand.

Outline of Site Chronology and Possible Sequences

The three separate analyses presented here can each be explained in terms of a circular argument.

This is true if each analysis is taken separately, but when all are taken together then the general agreement as to the placing of sites in groups can be taken as some



Figs. 63-68. Polished slate or stone knives from the South Island, typical forms (after Simmons 1967).

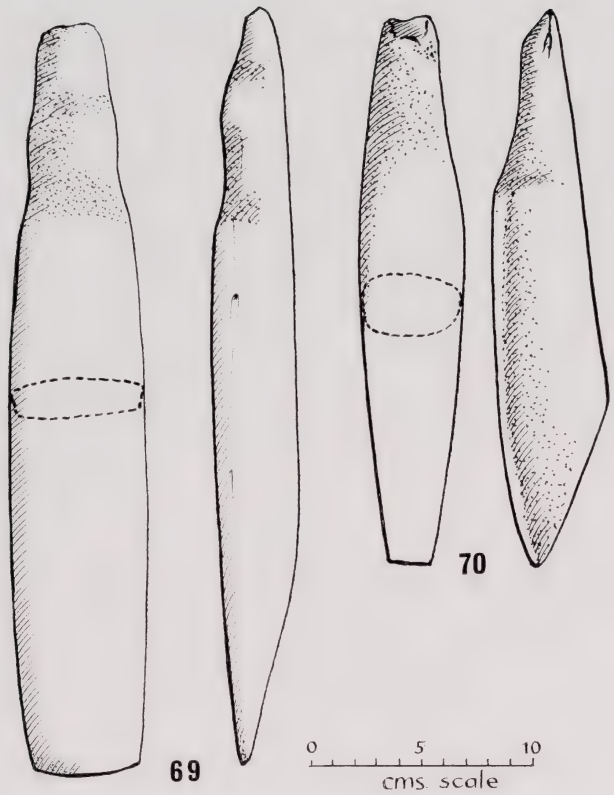
indication that these sites stand in certain relationships to each other. The major hypothesis which emerges from this relationship is that of an evolutionary sequence in the various items of material culture — a hypothesis which has been demonstrated for fishhooks by Trotter (Trotter 1965b) in his North Otago excavations, and for adzes at Little Papanui (Simmons 1967), though the latter is not a satisfactory archaeological demonstration. Many of the sites represented in museum collections are now destroyed, so that testing of this hypothesis is no longer possible at these sites, but this is immaterial to the general pattern which, if valid, should represent a testable hypothesis. By the very nature of the material used, mainly museum artifacts, it is to be expected that while the general pattern will stand up archaeologically, the details of any sequence will be modified. This is the reason why sites are grouped and not placed in a definite sequence. All that can be said with any surety is that certain assemblages have close relationships, and others differ in various degrees from these while more closely resembling other groups. In other words, one can only assess very crudely, degrees of similarity and difference between artifact assemblages. The resulting sequences for each area are given in Tables 13-18.

Table 13. Grouping of Southland sites, sequence.

	Adzes	Flake Material	Fishhooks	Ornaments
Group 4			Centre I	Pene Bay, Pahia Centre I
Group 3	Orepuke			
Group 2	Pahia Tokanui Mouth	(Wakapatu)	Pahia	
Group 1	Clifden	(Riverton)		Pahia Fortrose

( ) after Leach 1969

There are insufficient sites included in the analysis of Southland (Table 13) to form a valid sequence of groups. The Clifden adze cache certainly belongs in Group 1 as the adzes are identical in all respects to early adzes from Waitaki River Mouth or Wairau Bar Burials, even to the material used. The Pahia adze kit is a quite distinctive regional development (Figs. 69-70) and would suggest that the true placing of Pahia could be in Group 2, though, because Pahia is an abundant sea food area, it has probably been occupied as long as man has been in Southland. Two flake assemblages of Southland, Wakapatu and Riverton have been subjected to a computer analysis by Leach (Leach 1969). Radio carbon dates place Wakapatu about A.D. 1270. Riverton has various dates from A.D. 1204 to 1470 (Leach 1969, p. 65). Centre Island was a centre of late Maori occupation, though there is much earlier material on the island, the majority of the museum artifacts having been recovered from the late sites, which were attractive to collectors because of the presence of greenstone.



Figs. 69, 70. Typical examples of the Pahia adze kit. 69. Double front grip quadrangular, A.M.27684. 70. High rounded reversed quadrangular form, A.M.30132.

Table 14. Grouping of South Otago sites, sequence.

	Adzes	Flake Material	Fishhooks	Ornaments
Group 4			False I Cannibal Bay	
Group 3	King's Rock	Moa Flat (Papatowai) Cannibal Bay King's Rock	King's Rock	False I
Group 2	Papatowai			
Group 1	Pounawea	Papatowai Pounawea	Papatowai	Pounawea

( ) alternative or complementary placement

The sequence of sites for South Otago (Table 14) has already been well established by Lockerbie (1959). The analysis of the available artifacts indicates that simple analysis of the museum collections from these sites, without attempting to use the layer collections still being studied by Lockerbie, places these sites fairly well in the order suggested by him. Radio-carbon dates for these sites suggest that Pounawea was occupied from the 12th century; Papatowai from the 12-13th century; Cannibal Bay in the 16th century; False Island from the late 15th century, but mainly in the 17th century (Lockerbie 1959).

Table 15. Grouping of Otago sites, sequence.

	Adzes	Flake Material	Fishhooks	Ornaments
Group 4	Murdering Beach Tarewai Pt Little Papanui, top	Karitane Murdering Beach Kaikai's Beach, top Little Papanui, top	Tarewai Pt Long Beach Murdering Beach Karitane Little Papanui, top	Long Beach, top Kaikai's Beach, top Murdering Beach Karitane Tarewai Pt Little Papanui, top
Group 3	Sandfly Bay Little Papanui, mid	Little Papanui, mid Anderson's Bay Onepoto Matarae	Sandfly Bay	Sandfly Bay
Group 2	Little Papanui, bottom	Murdering Beach, Moa-hunter Kaikai's Beach, lower Little Papanui, bottom (Anderson's Bay)	Little Papanui, bottom	Little Papanui, bottom Long Beach, lower Kaikai's Beach, lower
Group 1				

( ) alternative or complementary placement

It will be noted that none of the sites in Otago (Table 15) — and this means the area around Dunedin Harbour — falls within Group 1. The grouping of layers and sites into the other groups appears relatively consistent. Many of the sites included here, such as Sandfly Bay, Anderson's Bay, Long Beach and Tarewai Pt, cannot be placed in any sequence except from their artifacts which are now in Otago Museum, as they have been destroyed. Group 2 sites probably belong between the 14th and 15th centuries, while the Group 4 sites are representative of an intrusive dominant culture of Classic Maori origin, which was later influenced by European contact.

Table 16. Grouping of North Otago sites, sequence.

	Adzes	Flake Material	Fishhooks	Ornaments
Group 4	Katiki	Katiki		Katiki
Group 3	Shag R, top	Tai Rua Kyeburn (Shag R)	Matakaea	Moeraki
Group 2	Shag R bottom (Waitaki R)	Shag R Pleasant R (Waitaki R) (Oturehua)	Ototara Shag R Waimataitai Tai Rua	Shag R
Group 1		Waimataitai Waitaki R Oturehua		Waitaki R

( ) alternative or complementary placement

Michael Trotter's sequence for North Otago (Table 16) is in line with the radiocarbon dates which place Waimataitai in the 13th century, Ototara in the 15th century, Tai Rua in the late 15th century, and Katiki in the 18th century (Trotter 1967c). Leach's date for Oturehua Quarry site is early 11th century (Leach 1969) and Hjarno's date for Shag River bottom layer is 12th century. This latter date comes from a different area of the site to Teviotdale's lower level and may represent an earlier occupation.

Table 17. Grouping of Canterbury sites, sequence.

	Adzes	Flake Material	Fishhooks	Ornaments
Group 4	Moa Bone Pt Cave, upper Monck's Cave	Bromley Monck's Cave	Monck's Cave	
Group 3		(Rakaia R)		Rakaia R Moa Bone Pt Cave
Group 2	Pareora R Motukarara Rakaia	Rakaia R (Monck's Cave) (Sumner)		
Group 1	Hurunui Sumner	Sumner Gray's Hills Pareora R		Hurunui Pareora R Sumner

( ) alternative or complementary placement

There are too few sites included from the Canterbury area (Table 17) for any suggestion of a sequence. The Sumner site on Redcliffs Flat was excavated by Haast in 1872 (Haast 1875a). Recent radio-carbon dates for what appears to be similar occupation on another area, place the earliest occupation at A.D. 1163 ± 82 (Trotter 1967b, p. 253). The surface artifacts from Monck's Cave include a range of Classic Maori artifacts, such as a bailer and combs (Skinner 1923).

Table 18. Grouping of Marlborough sites.

	Adzes	Flake Material	Fishhooks	Ornaments
Group 4				
Group 3				
Group 2	Wairau Bar Burials	(Wairau Bar)		
Group 1	Wairau Bar Midden	Wairau Bar Midden	Wairau Bar Midden	Wairau Bar Midden

Radio-carbon dates for Wairau Bar (Table 18) are A.D. 1015 ± 110 and A.D. 1225 ± 50 (Duff 1956, p. xii) from oven charcoal found at *c.* 43-76cm (17-30in) below the surface. This presumably dates the midden layer in an area not disturbed by burials.

Discussion

The general agreement in the order of sites when the separate analyses are taken together suggests that the four major divisions represent periods of change within South Island prehistory. These four divisions are thought to correspond with the ecological changes outlined earlier. Within each artifact class with a continuous distribution a tendency to change is apparent. It is a gradual process, with the cultural assemblage at any point in time being stable, until the intrusive Classic Maori culture absorbs the earlier culture.

Adzes and fishhooks of Period 1 belong to the New Zealand form of East Polynesian culture. The adzes are more often than not rendered in baked argillite from the D'Urville I.-Nelson region, and show an early dominance of triangular apex up with grip, and include a range of other adze types, but with only a very small proportion of reversed quadrangular with or without grip (e.g. Heaphy and Wairau Bar Midden). This latter contrasts quite strongly with material from sites such as Mt Camel, Houhora (report in preparation by F. W. Shawcross, surface collections, and N. Roe 1967), or from sites in Coromandel or Nelson where reversed quadrangular and triangular apex up adzes with or without grip are the dominants, with quadrangular front grip adzes occurring in the upper layer at Houhora (Roe 1967, p. 46). Regional variation could account for this distribution, but this is unlikely on two counts: firstly, the resemblance between the adze distribution of the Northern sites and early sites in the Pacific (see Green 1971, Fig. 2); secondly, the distribution of sites with three major foci (Far North, Coromandel, Nelson), and a number of single sites (e.g. Ohiwa, Wainui, S. Manukau

Hd), suggesting a group or groups able to expand into unoccupied territories. It is reasonable to assume these represent the Settlement Period of the East Polynesian Culture in New Zealand. Details of the artifact distribution for the North Island are the subject of a paper in preparation.

In terms of the Settlement Period adze material, the earliest (or what artifactually appears to be the earliest) sites in the South Island included in this study are the Heaphy site and the Wairau Bar Midden assemblages. The radio-carbon date of A.D. 1518 ± 70 for the Heaphy site dates the later phases of occupation (Simmons 1969, p. 16). Heaphy and the Wairau Bar Midden follow on from the North Island Settlement Period in that they have appreciable numbers of triangular apex up adzes with many fewer quadrangular front grip. Group 1, South Island, adzes belong to a specifically New Zealand version of the East Polynesian culture, as they do include some purely local developments such as the side hafted or the thin triangular apex down with grip (coffin shape). This latter adze, the coffin shape, while it is related to high triangular forms found in the Far North or the Marquesas Is, would appear to be purely a South Island form. Another factor is the identity of the adze forms represented. Except for the coffin shape, every other adze in the Group 1 collections can be matched exactly with other examples from Werahi Beach in the Far North or the Clifden cache in the Far South. The majority of these are rendered in argillite from the D'Urville-Nelson belt and cannot be localized on morphological criteria.

A feature which is illustrated by the Clifden cache (Fig. 71), from near Tuatapere in Southland, is that half of the Clifden adzes are made from D'Urville-Nelson argillite, the rest — including some not quite finished — from the local Orepuke argillite, indicating a movement from North to South.

Fig. 71. Clifden cache. (Field photo: L. M. Cowell.)

The four major periods of South Island prehistory as defined from the artifacts are in this study thought to be correlated with the following economic periods:

I THE EARLY PERIOD, South Island aspect of the New Zealand East Polynesian culture: *c.* A.D. 1000-1200.

Basic economy: coastal-forest hunting, with a wide range of sea-mammal and birds being exploited.

II THE MIDDLE PERIOD, South Island aspect of the New Zealand East Polynesian culture. Regional aspects, Southland, South Otago, Otago, North Otago, Canterbury, Marlborough: *c.* A.D. 1200-1400.

Basic economy: coastal-forest hunting, with a more restricted range of birds, few sea-mammals and much fish.

III THE INTERMEDIATE PERIOD, of New Zealand East Polynesian South Island culture. Local regional aspects, King's Rock aspect, Dunedin aspect, Central Otago aspect, Tai Rua aspect: *c.* A.D. 1400-1800 in Murihiku; *c.* A.D. 1400-1550 in Canterbury and North.

Basic economy: restricted forest hunting, sea fishing, with very little bird; a wide range of fish, shellfish and, initially, sea-mammals.

IV THE LATE PERIOD, South Island aspect of the Classic Maori culture. Canterbury-Marlborough aspect: *c.* A.D. 1550-1820. Murihiku aspect with some amalgamation of earlier cultural items: *c.* A.D. 1800-1820.

Basic economy: Canterbury, kumara agricultural until *c.* A.D. 1800, then kumara-potato; Murihiku, potato agriculture; both of which are associated with seasonal stations.

This overall delineation of the major periods obscures an important feature stressed earlier, that is, the developmental nature of the artifacts themselves. In Periods I, II and III the changes are gradual and cumulative from I to III. Period IV, while it does incorporate some Period III artifacts or forms, notably spade shouldered adzes and flake material, as in Murdering Beach, is, nevertheless, an abrupt and sudden intrusion of a new cultural group. Whatever the identity of the original settlers in New Zealand, the end product of change in the North Island produced a very different cultural group of Classic Maori, separated by at least six hundred years of development from the inhabitants of the South Island. In the artifact record the picture of slow and continuous development of the South Island is not disturbed until the intrusion of the Classic Maori. Any other intrusions that may have taken place are not detectable.

It is also significant methodologically that even when using surface material, an artifact analysis can suggest that there are four major peaks or foci of change in South Island prehistory. Thus it is possible to get an idea of the correct placement of a site by the analysis of a single artifact class, but more surety is given to this placement by the separate analyses of other artifact classes.

In the field, this placement may be corroborated or otherwise by other information, such as position of site, type of economy and raw materials used. On the basis of Museum studies an overall picture of site distribution can be formed and sites likely

to yield desired information can be identified for excavation. Many sites, though, have been totally destroyed and only the artifacts are preserved in Museums. In that case simple artifact analyses, such as presented here, show how these sites can be related to the prehistory of the area.

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